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The Sewerage of the Passaic Valley in New Jersey.

The disposal of the sewage of the communities in the Passaic valley in northern New Jersey is again receiving much attention, and there is an apparent determination to undertake the problem at the earliest possible date. This decision has been reached before, only to be abandoned for one reason or another, but the increasing importance of the subject indicates that probably something will be done this winter which will be of direct avail. The situation is a most interesting example of the necessity of looking far ahead in planning the public works of a suburban district. In this particular district are three considerable cities, Newark, Paterson and Passaic, in addition to numerous smaller communities. The magnitude of the problem does not depend so much on the three large cities, although the disposal of their sewage is the leading factor in determining the capacity of whatever works are built for immediate service, as it does on the great development bound to take place shortly in the whole district under consideration. Not so many years ago the officers of one of the leading railroads in this district considered the transportation needs of the corn-fed hogs of Kansas much more important than the daily service of humble commuters. The suburbanites traveling by another line were accustomed to hold their breath whenever their trains came to the bridges, and felt like going down on their knees in thanksgiving when these danger points were passed in safety. All this has now changed. The suburban service is good and will shortly be greatly improved by electric operation on the two leading railways reaching the valley. Tunnels are under construction which will deliver passengers in New York from the Jersey shore without any of the inconvenience attending ferry transportation. Electric railways are to connect Newark and New York by way of tunnels under the Hudson which will furnish a real rapid transit between the two cities. As a result of all this a great suburban population will speedily grow up in the Passaic valley, which will make the sewage problem vastly more complex than it is usually considered, for it will involve intercepting the sewage of many residential communities scattered along the whole length of the district under consideration and delivering it at some place on the water front in a manner that will not cause offense.

If the people of the valley are really in earnest in their desire to secure the construction of works to purify the Passaic River, now almost as fetid as the Chicago River before the opening of the drainage canal, they should bear in mind two things, first, that the engineering problems are so difficult when considered in the light of future requirements as to make it dangerous to settle them without real expert advice, and, second, that the management and financing of the undertaking in the past has been so strangely bungled that it would be well to take an entirely fresh start. There has been too much legislation on the subject. During the administration of Governor Griggs, that gentleman referred in one of his messages to the absence of any adequate laws for organizing and carrying to completion such an undertaking. Acccordingly, such laws were passed, taking from the control of the State Sewerage Commission any authority over the Passaic Valley and organizing a special commission to handle the project. According to Governor Griggs this was the only method of solving the problem. The new commission organized and secured preliminary reports from various engineers, but was eventually put out of active business by the courts, although it is still in existence shorn of all powers for accomplishing anything. It is worth noticing that the man who deprived the commission of these powers by his able arguments before the courts, was ex-Governor Griggs, acting as counsel for the city of Paterson, his home, which has never been enthusiastic in favor of such a project. While this fiasco was being played in the Passaic Valley, a number of less wealthy communities to the south perfected among themselves a private commission for building just such an outfall sewer. No help was asked from the Legislature, no commissioners with high salaries were appointed, no court difficulties have arisen. These communities have acted like business people about a business matter. The fact that an eminent lawyer, occupying for the moment the Governor's chair, said that a thing could not be done did not deter them from acting as their common sense dictated. Consequently, this outfall sewerage system has been completed and is now working satisfactorily, while the Passaic Valley undertaking has not yet emerged from the realm of talk. This is a condition of affairs that ought to be carefully considered by those who are really in earnest in this matter.

As the matter now stands, Governor Stokes probably has a more important influence on the future of the project than any other individual. He can urge upon the Legislature the modification of the act creating a special sewerage commission for the valley, so that the latter body may possibly be able to avoid further judicial pitfalls, or he can accept the precedent of the great outfall works emptying into the Arthur Kill and urge a return to the original status quo before any special legislation was enacted. Something is to be said for both plans. It is to be hoped that in deciding upon their relative merits he will free himself entirely from any consideration of the engineering features of the work. They can be attended to by engineers after some plan for managing the undertaking is settled. A great deal of talk about trunk sewers, septic tanks, tidal disposal and the like is indulged in by amiable gentlemen whose ideas on the subject are so mistaken as to be amusing to engineers. These gentlemen will help along the work of preventing the further pollution of the river by sticking to their lasts and aiding the formation of some organization for handling the enterprise in an economical and legal manner, which the city of Paterson cannot disrupt as easily as it tore in two the present laws for a special commission.

There is something that should be said for the engineering problem, however, even at this time. There is no question about the necessity of a trunk sewer to intercept the sewage which is now discharged into the river. Such sewers will have to be built in any case. The only serious engineering problem is to dispose of the sewage when it is collected. Up to the present time the only study made of the subject on which much time was spent was that by Mr. Rudolph Hering. It was merely a preliminary study, however, and a more careful investigation of details might lead him to modify it. It might be pointed out, however, that such an investigation will take considerable time, and that it is important for hygienic reasons to get to work at the earliest possible moment. The wise plan to follow, therefore, is to organize a commission in such way as the Governor thinks best, plan out the details of the trunk sewer, which must be built anyway, and begin at once such a complete study of the problem of disposal that no parties can maintain a successful opposition to the plans that are finally definitely adopted.

Tunnels and Bridges.

One of the most marked developments in modern engineering, particularly within the past half dozen years, is the increased use of tunnels for passage under rivers near large cities, although in some cases for continuous lines of transit like the subways of New York and Boston, and those under discussion for a number of large cities. Some engineers of prominence have for many years advocated the construction of tunnels under rivers to a far greater extent than has hitherto been done, rather than the building of bridges over them, but on the whole it may be stated that tunnels have until lately been built in practically no places where it has been feasible to build bridges. That situation, however, is now essentially changed and the change is due to a number of reasons so substantial that the use of tunnels is likely to extend in a marked manner in the near future.

Projects for bridging both the North and East rivers at New York have been floating in the minds of agitators, promoters and some prominent engineers for many years, in fact for fully a hundred years; but projects for tunneling these rivers have been comparatively rare, the only exception of much consequence being that of the North River tunnel begun not far from twenty-five years ago and now practically completed. Indeed it is well known that the Pennsylvania Railroad Co. itself was at least indirectly interested in a project for a single-span bridge across the North River within a half dozen years, and practically the same observation may be applied to two or three other railroad companies with lines approaching New York City from the West.

With comparative suddenness the situation is now changed so that any private enterprise for bridging either the Hudson or the East rivers has little or no chance for a successful issue. It cannot be maintained that this condition is peculiar to the City of New York, although there are found at that point highly accentuated features. Tunnels have been built under the Chicago River for many years and the Sarnia tunnel under Detroit River has afforded passage for Grand Trunk trains for nearly the same period, and another tunnel is soon to be constructed at Detroit. The East Boston tunnel is also a case in point, showing the availability of this system of communication between cities or portions of cities. It is not meant by these observations to intimate that bridges are now becoming obsolete but simply to show that communication by tunnels is being rapidly developed.

It is but a truism to state that as a rule the most economical means of communication will be adopted wherever the question lies between tunnel and bridge, but it is interesting to analyze the matter a little closer in the attempt to ascertain why tunnels have become so popular in so short a time, although a sub-surface line of communication is far less agreeable to follow than one above ground. In the first place various methods of tunneling have been greatly developed, so that systems of construction have become simplified and made much more economical than formerly, at the same time materially enhancing safety, both in construction and operation. The tunnels completed recently in Boston and New York exhibit in a remarkable manner not only great improvements in the design and use of shields, but also the highly enhanced economy which has been reached in tunnel construction by the aid of compressed air. The process of forcing a shield through soft material as a mole forces its way through the ground, i. e., without excavating the material, is sufficient to account for the economy of that particular tunnel under the North River in which Mr. Jacobs, the chief engineer, attained those results; but that is exceptional. The regular or standard use of the shield has been so far developed by improvements in design and by increased skill and efficiency in its employment that railway tunnels can now be built through any soft material, or material not hard, at a reasonable expense where the cost formerly would have been prohibitory. Even this feature of the subject, however, is probably not sufficient for a complete explanation of recent tunnel developments.

A careful consideration of all the conditions attending the construction of a great bridge in a city or in its vicinity where real estate has high value will disclose the influence of undoubtedly the most important agent in this class of problems. A great bridge requires a relatively large area of ground for its approaches and the higher the structure as a rule the greater will be the area occupied by those approaches. The high cost of real estate, especially where covered by buildings, is a most serious handicap, which has sometimes proved fatal for a bridge project when its approaches must occupy that kind of a territory. This condition has been illustrated in a most emphatic manner by the cost of the approaches for the suspension bridge across the East River at New York. The actual cost of bridge construction is relatively a small matter compared with the enormous costs of real estate required for such high level structures. The approaches of a tunnel on the other hand involve little or no expense for real estate. Some rights may occasionally be trenched upon, but as a rule the cost of a tunnel is the cost of its construction only, requiring a light outlay if any for approaches. The grades leading to a bridge structure must be easy, so that the traffic which it accommodates may readily attain the roadway of the structure. If the latter is at considerable elevation, as is usually the case, an approach structure sometimes longer than the actual bridge itself is required. If, as in many cases, approaches leading in several directions are required the case is aggravated. These comparisons hold true even where a tunnel line comes to the surface within thickly populated districts, as is frequently the case. The approach in such an instance is simply a hole in the ground with an excavation leading to it, the purchase of real property being reduced to a very small matter.

It is practically certain that tunnel development for city lines of transportation has but begun. The methods and materials required to make the passage of a tunnel agreeable are now abundantly available at low costs, so that while probably no one would prefer an underground passage to one on a bridge the difference in attractiveness between the two systems has been reduced to an extremely small fraction of what it was but ten or twenty years ago. On the other hand the enormous carrying capacity which must be given to such bridges at the present time increases their costs not only as structures but also much more in consequence of the greatly extended approach accommodations required. With the increase in population of great cities, therefore, a tunnel proposition is almost inevitably bound to arise wherever lines of transportation are required across rivers, and the existing tendency toward subway construction appears to indicate with equal certainty that sub-surface lines of transportation are sure to gain the ascendency in intermural locations where the density of population reaches that already attained in many American cities.

The Real Influence of Moving Loads on Bridge Structures.

While the fact is recognized that the methods of determining stresses in bridges for static loads do not apply to moving loads, there still continues to be a great dearth of experimental work to ascertain just what happens to bridges under trains. There have been studies of this sort in France and to a somewhat less extent in Germany, but the only published data of wide range obtained on American roads are to be found in Professor Turneaure's paper before the American Society of Civil Engineers seven years ago. The theoretical investigations of the subject since that time have demonstrated the great need of experimental determinations of moving load stresses in actual structures by regular train loads before the solution of the real problem can be reached. This journal has repeatedly pointed out that, strictly speaking, considerations of fatigue do not touch the question, or, rather, that it does not touch them, for the reason that there should be no fatigue at even the greatest working stresses employed in design.

It is of much importance, then, to ascertain what actual stresses exist in the members of girders and trusses when they carry trains at all possible speeds. This is the key to the problem, but does not admit of analytical treatment, only of experimental determination. Owing to the renewed interest in the subject attention may well be called again to the three hundred tests made by Professor Turneaure, reviewed in this journal on Dec. 3, 1898. These experiments were made on plate girder spans of 25 to 85 ft. and truss spans of 104 to 200 ft. The center deflection of the girder or truss is an important element in a complete investigation of this character, although it does not bear directly on the stress determinations; Professor Turneaure's investigation possessed a satisfactory completeness because he employed a deflectometer as well as extensometer. The two most important aspects of the subject on which such experimental investigations bear are the effect of train speed and the increased stresses due to the vibrations of the structures under passing trains at different speeds, while the relations between the center deflections and the chord and web stresses are also of much value.

Although the effects of train speed alone must be conjectural to some extent, yet the evidence accumulated up to the present time confirms Professor Turneaure's conclusion that "the effect of speed alone on bridges of spans exceeding 40 ft. in length is of no consequence whatever." It may be that this conclusion is applicable to spans under 40 ft. when the track is in first-class condition. It must be understood that no moving train load is suddenly applied, or even approximately so. The sudden application of a load means the instantaneous application of its whole magnitude at one point, and its remaining there long enough to produce double the deflection of its gradual application. Obviously no railway train can even approximately fulfill these conditions, and the sudden application theory of loading has only an academic place in bridge design. This is hardly so important as it was a few years ago when, through a misunderstanding of just what was meant by impact allowance, it was held in some quarters that a moving load is essentially a suddenly applied load. As a matter of fact the effects of so-called suddenness are attributable more properly to vibration. For example, in Professor Turneaure's paper, the portion relating to vibrations really includes such shock or impact phenomena as existed in the experimental cases, and in this category will be found practically all the real difference between the stresses caused by static and moving loads.

In speaking in this way of vibrations it is of course intended to include under that term not only the effects of the counterbalance weights of locomotive driving wheels and the unbalanced weights of the reciprocating parts, but also the effects of imperfections in the track, however indeterminate they may be. Professor Turneaure's experiments showed that the counterbalance weights of driving wheels were the chief factors in setting up vibration in the structures tested, and his measurements indicated a considerable relation between the number of revolutions of the drivers and the vibrations. This proves the truth of the assertion made many times by the late George S. Morison, that bridge stresses could be materially reduced by the use of perfectly balanced locomotives, and explains the financial interest he took in the Strong locomotive. The highest speed attained in Professor Turneaure's experiments was 60 miles an hour, and up to that limit the apparent maximum stress added by the vibrations scarcely exceeded 50 per cent. of the computed static stress in plate girders not over 55 ft. long. In girders from 60 to 85 ft. long the addition was not over 28 per cent. of the static stress. In trusses the percentage of additional stress due to vibrations reached 80 per cent. in the middle diagonal of one structure, but rarely exceeded 25 or 30 per cent. in either chords or diagonals. These results show that the present practice in allowing for moving loads is manifestly safe, whatever else may be said about it.

Notes and Comments.

Boiler Efficiency is a very interesting subject of investigation when based on tests made with different coals. Given a certain grade of coal, whether high or low in volatile matter, there is some fixed number of heat units which can be generated by its complete combustion, and this represents its heat value. The practical question is how much water can be evaporated with this quantity of heat, while an expression of boiler economy states what part of this heat is taken up by the boiler, two different things. The use of efficiency percentages to indicate economy is peculiarly adapted to boilers fired with volatile coals, such as are found in the West. A high efficiency means much more with a boiler using Illinois coal than with one using coal from Maryland or Virginia, for it is much more difficult to obtain it in the former instance. To handle volatile coals efficiently there must be special means employed for consuming the gases before they are so far cooled as to escape ignition. A boiler which will do this with a certain high degree of efficiency under the adverse conditions attending the use of Illinois coal is entitled to better consideration than one obtaining the same percentage using Cumberland coal. The only way to bring such facts to the surface is to state the economy in terms of efficiency, for they cannot be brought out by a simple statement of evaporative performance.

Testing Steam Plants ought not to be restricted to the acceptance trials, for no matter how well designed a plant may be or how economical when worked in accordance with the designer's intentions, the results when it is left to careless or ignorant hands are bound to become unsatisfactory. The plant is a complicated affair, as a whole, although the boilers, engines and auxiliaries may be simple enough in themselves. Though the engine may produce an indicated horse-power per 1.5 lb. of coal per hour, there is no certainty that the plant as a whole is operating at this economical rate. Indicating apparatus, common enough now in power plants, is useful in determining the operation of an engine, but it only tells a part of the story of the way the entire plant is running. The operation of the auxiliaries, the way in which the coal is handled from the cars or barges until it is put on the grates, the efficiency of the boiler plant and other factors are just as important. Consequently there are many factories to-day which would find it highly profitable to have an expert run their power plants under working conditions long enough to establish what may be called standards of performance. These plant standards could then be used in judging the manner in which the regular crews are doing their work.

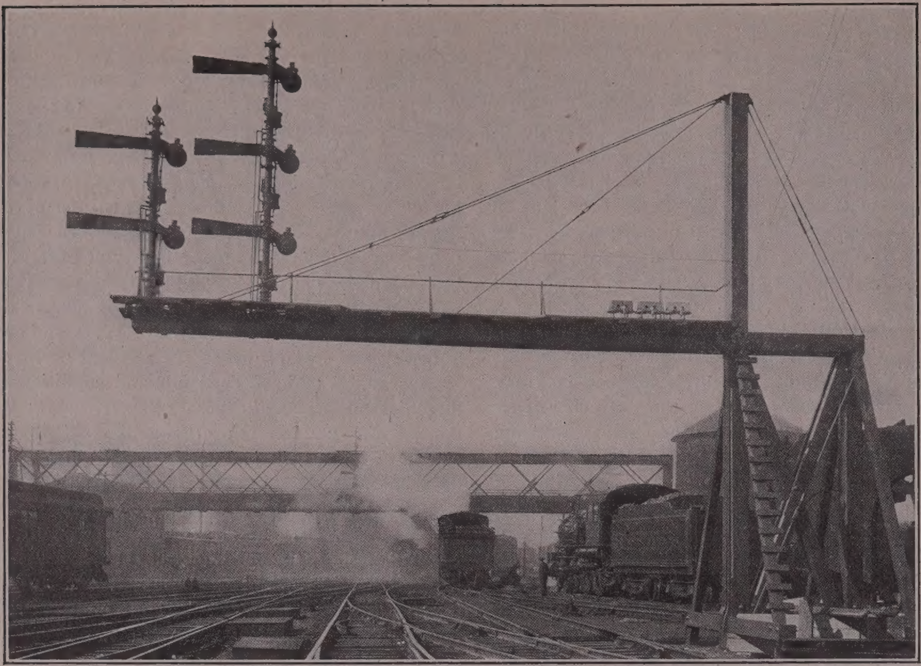
The Extent of the Public Works of New York City is shown by the fact that a flourishing engineering organization of nearly four hundred members now exists among the consulting engineers and employes of the various municipal departments. This society, known as the "Municipal Engineers of the City of New York," was organized several years ago and was incorporated on Dec. 23, 1903. When the Union Engineering Building is opened the society will have its headquarters there, but is now housed in a suite in an apartment house, where an excellent working library and files of current periodicals are available for the use of the members day and evening, including Sundays and holidays. Excellent papers are read at the meetings, and visits are made to points of engineering interest in the vicinity. The society is devoting itself to municipal subjects exclusively, and has already gathered together in its library and its very creditable publication a mass of data on such subjects of unique character and high value. The importance of this organization in furthering the city's interest is great. The municipality is so large, the character of its surface conditions so varied, and its engineering problems so manifold and complex, that such an organization, bringing together those working out these problems in the different boroughs, has a special field of usefulness distinct from that of local general engineering clubs and the national societies. No city has a better technical staff than that which cares for the public engineering of New York, and this voluntary organization of its members "to further the material development of the city and to elevate the standard of efficiency and harmonize the work of the engineering staffs of the several departments of the public service" is an indication of a professional spirit which deserves recognition by those critics who assert that city engineering tends to pull down the character of those following it.

The Public Works of the City of Columbus, O., have lately been a sort of Mecca to municipal engineers desirous of studying recent developments in water and sewage purification. These problems, as they were presented in Columbus, were unusually complex. The water most available for an additional supply is not only exposed to the danger of some contamination but is also very hard, so that the treatment must provide, not only for purification, but also for softening on a scale never before attempted. The sewage disposal problem is rendered difficult because of the great cost at Columbus of works of the character previously used in large cities. These problems were too serious, on account of public health and the great expenditures involved, for solution in the usual way, and Mr. Julian Griggs, chief engineer of the Board of Public Service, accordingly organized a special corps for conducting the work, as previously urged, not only by himself, but by all consulting engineers of the city and by the Ohio State Board of Health. This involved a thorough experimental study of water softening and sewage purification, and the design of works based on the results of these investigations. Experienced men were brought together from many cities and eminent consulting specialists were retained to supervise the whole work. In short, Mr. Griggs very properly put each detail of the work in the hands of a thoroughly competent man and devoted his energy to helping them act harmoniously. This has made necessary the payment of considerable money for preliminaries. On the other hand, it is stated officially to have saved the taxpayers the needless expenditure of hundreds of thousands of dollars in construction charges and to have produced plans for efficient work with minimum operating expenses. This is the best kind of engineering, and the taxpayers of the city are to be congratulated that their city engineer takes such a broad view of public professional policy. With the execution of the plans and the operation of the completed works conducted in the same way as the preliminary studies and the designs, Columbus will occupy a unique position in this country and will have made a record of which to be proud.

A 20-Inch Steam Main in the boiler room of the Potomac Electric Power Co., at Washington, D. C., exploded on Nov. 1, killing two men and seriously injuring a number more. From the testimony of the chief engineer at the inquest of one of the victims it appears that the main was put together with threaded flanges. The accident was caused by one of the joints opening about 20 in., flooding the room with scalding steam. One of the flanges at this joint was found to be cracked in five places, allowing the pipe to pull out of it. The thread on the end of the pipe and the pipe itself were intact. The main had been in practically continuous service for about three years and was under 177 lb. pressure when the accident occurred. It was stated to have been in good condition by the chief engineer and several other witnesses, but one of the boiler-room attendants said that a couple of leaks in it had been stopped only a few days before the explosion. The explanation that is commonly accepted for the accident is that it was due to water hammer, but the testimony at the inquest brought out no grounds for any such belief. The accident gives another example of the unreliability of threaded flanges for high-pressure piping, a fact that is pretty well recognized by steam specialists.

The Use of Concrete Blocks continues to spread in sections of the country where other building materials of good quality are available. For example the Twin City Rapid Transit Co., of Minneapolis, is erecting very large car shops which will require six hundred thousand blocks. These shops include a 75 x 200-ft. mill, a 100 x 300-ft. store house, a 50 x 100-ft. power house, a 126 x 300-ft. paint shop, a 150 x 200-ft. machine shop, a 50 x 200-ft. smithy, and a 60 x 200-ft. foundry. The blocks are being made on the ground at the rate of about 800 a day with a "Perfection" machine. In Greenfield, Mass., Mr. F. O. Wells is erecting a large apartment house in which these blocks will be used for the walls and reinforced concrete elsewhere, with aluminite floors. The only wood in the structure will be in the windows, doors and the elevator trim, and the owner is so well satisfied with the building's fire-resisting character that he will take out no insurance.

The Luxury of American Trains is well shown by the cars exhibited a few days ago at the Wells St. Station in Chicago by the Chicago & North Western Ry. These have just been turned out of the Pullman shops for service between Chicago and St. Paul, and represent the highest development in car construction up to the present time. The sleeping cars are 72 ft. long from sill to sill and contain ten sections and either three staterooms or a drawing-room and two staterooms. The later are slightly longer than usual and the sections have berths several inches longer than the usual standard. The arrangement of the toilet rooms is entirely new, and a feature which was at once noticed by visitors to the train is the use of porcelain instead of metal washstands. The train is lighted by electricity furnished from a generating set in the baggage car. Each berth has a reading lamp, and the illumination in the chair cars and day coaches is furnished by rows of incandescent lamps along the sides in addition to the usual overhead cluster lights. Special attention was paid to the steel-girder frames of these cars, and they are believed to be the strongest construction yet designed. It is not wholly satisfactory to those who boast of the luxury of the East to reflect that in all probability there is no train in regular service from New York which is quite equal to this, and while The Engineering Record does not attempt to cover in its reading pages the design of rolling stock, the luxurious character of this new train deserves mention as a matter of considerable interest to many of its engineering readers.



Temporary Signal Stand in Terminal Yard.

TERMINAL YARD IMPROVEMENTS OF THE NEW YORK CENTRAL & HUDSON RIVER R. R.

Before the commencement of the terminal improvements all trains entered the Grand Central Station at 42d St., New York, through the four-track masonry tunnel in Park Ave., which terminated at 56th St. Thence to 49th St. the tracks ascended 17 ft. in an open cut and entered an open yard, descending 3 ft. to street level at the station. The yard had an irregular area about two blocks in width and seven blocks in length and covered 23 acres with its 11.3 miles of tracks and several buildings for freight, express operations and storage purposes. North of 49th St. vehicular traffic was maintained on both sides of Park Ave., the tracks occupying the center of the street only; between 49th and 42d Sts. the tracks spread out into the terminal yard and also occupied the full width of the avenue. Street traffic was carried across the yard by inclines with a long-span truss bridge on the center line of 48th St. and by a girder bridge over the cut in Park Ave., between 51st and 52d Sts. Foot bridges crossed the yard at 47th and 49th Sts. and crossed the cut at 50th, 53d, 54th and 55th Sts. These were elevated above the street level and approached by stairs and, at the east end of 47th St., by an incline.

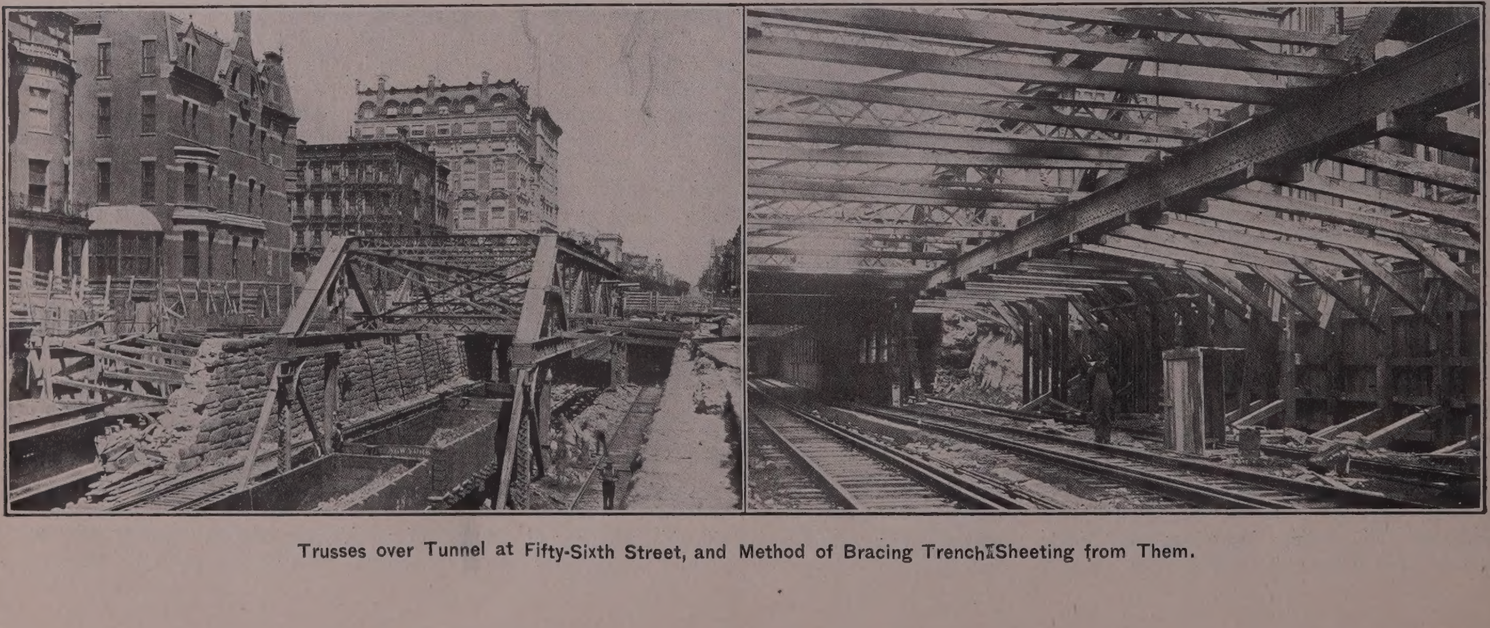
The improvements now in progress will keep the entrance of the tunnel as before at 56th St., but will depress the tracks at that point and provide for ten tracks instead of four as formerly; the yard will be depressed to a level about 15 ft. lower than before and will be extended to a maximum width of about 135 ft. in Park Ave. north of 50th St., and from Lexington Ave. to a line near Madison Ave. south of 50th St. About 17.5 miles of new and rearranged old tracks will be laid in the 43-acre yard; a 24-acre sub-surface yard 475 ft. wide with 10 miles of track, will be constructed about 22 ft. below the main yard on the center line of Park Ave. and will extend from 52d St. to and through the new station. A steel plate girder viaduct extending longitudinally through the center of the yard will carry the full width of Park Ave. from 56th St. to the new station at 45th St. and twelve plate girder viaducts from about 45 to 63 ft. wide and 50 to 950 ft. long will carry all intersecting transverse streets across the yards. No change will be made in the grades of the cross streets. A new terminal station will be constructed with connections to the Rapid Transit Subway at the level of the suburban train platform and uninterrupted and increased train service during the execution of these improvements will be facilitated by the construction of a large temporary passenger station on the east side of the new yard and by the transfer of the engineering and other offices to a new building at Madison Ave. and 44th St. The important results attained by these improvements are given in the accompanying table.

This work requires, outside the station building, the excavation of over 1,500,000 cu. yd. of

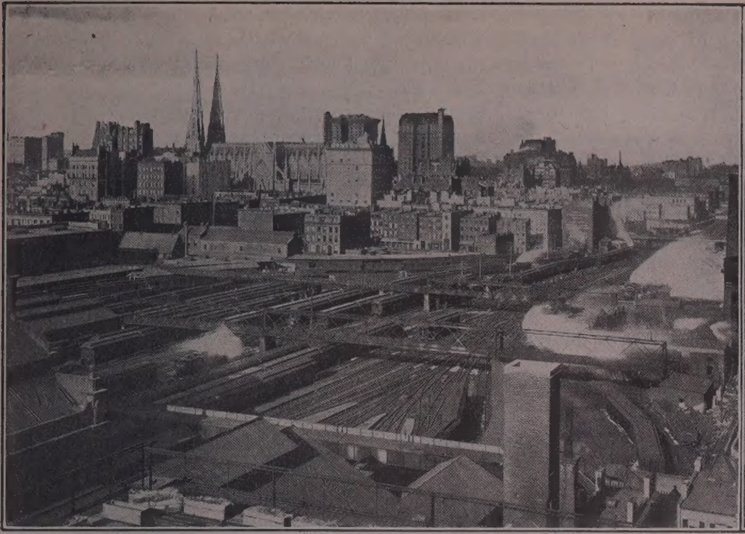
TABLE SHOWING FACILITIES AT GRAND CENTRAL TERMINAL BEFORE AND AFTER IMPROVEMENTS.

Subject.	Present amount			Proposed amount				Increase
	Mott Haven.	G.C.S.	Total.	Sub level.	Exp. level.	St. level.	Total.	%
Terminal area, acres	....	23.24	23.24	24.22	40.32	....	64.54	178
Tracks, platform, miles	....	2.91	2.91	2.07	3.70	....	5.77	98
Storage, miles	....	1.54	1.54	2.94	5.57	....	8.51	453
Express, miles	....	0.35	0.35	....	0.86	....	0.86	146
Mail, miles	....	0.16	0.16	....	0.20	....	0.20	25
Other, miles	....	5.88	5.88	5.58	6.25	....	11.83	101
Total, miles	....	10.84	10.84	10.59	16.58	....	27.17	151
Tracks, car capacity (*a*).								
Platform	....	214	214	177	273	....	450	110
Storage	525	115	640	249	394	....	643	0.5 (*b*)
Express	....	26	26	....	61	....	61	135
Mail	....	11	11	....	15	....	15	36
Total	525	366	891	426	743	....	1,169	31
Tracks, platform, number	....	19	19	15	20	....	35	84
Ground area, building, acres	....	5.90	5.90	....	....	8.10	8.10	37
Offices, sq. ft.	....	129,500	129,500	....	....	426,694	426,694	229
Post-Office, sq. ft.	....	33,000	33,000	....	....	104,577	104,577	217
Waiting rooms, sq. ft.	....	12,443	12,443	....	24,697	....	24,697	98
Retiring and toilet rooms, sq. ft.	....	1,391	1,391	....	9,080	....	9,080	553
Restaurant and accessories, sq. ft.	....	2,647	2,647	....	16,454	....	16,454	522
Ticket offices, sq. ft.	....	1,444	1,444	....	2,295	....	2,295	58
Parcel stand, sq. ft.	....	507	507	....	1,320	....	1,320	161
Baggage rooms, sq. ft.	....	33,315	33,315	....	60.800	....	62,940	88
Concourses, sq. ft.	....	14,814	14,814	53,750	67,200	....	120,950	717
Ticket lobby, sq. ft.	....	1,490	1,490	....	....	18,298	18,298	1,128
Cab stands, sq. ft.	....	2,952	2,952	....	11,535	28,105	39,640	1,243
Cab curbs, lin. ft.	....	125	125	....	275	580	855	584 (*c*)
Office corridors, sq. ft.	....	18,210	18,210	....	....	120,222	120,222	560
Office toilets, sq. ft.	....	2,482	2,482	....	....	15,920	15,920	541
Steel viaducts, sq. ft.	....	....	....	....	....	569,780	569,780	0

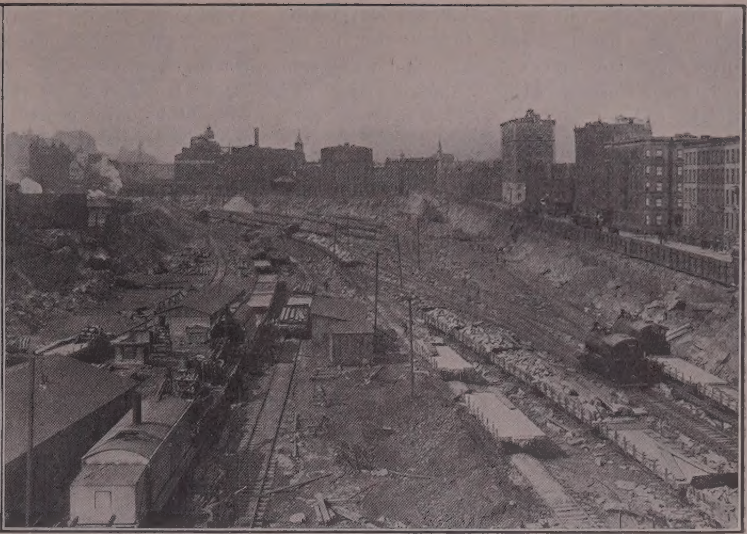
(*a*) In measuring the car capacity of the tracks, 60 ft. is allowed in the suburban station and 70 ft. in the express station. (*b*) Considering the storage tracks at the Grand Central Station only, there has been an increase of 528 cars or 459 per cent. (*c*) These figures are indepen dent of public street curb.



Trusses over Tunnel at Fifty-Sixth Street, and Method of Bracing Trench Sheeting from Them.



Terminal Tracks Before Beginning of Improvements.



Excavating Depressed Yard East of Old Terminal Tracks.

rock and 1,000,000 cu. yd. of earth, the erection of 69,000 tons of steel and the laying of 200,000 cu. yd. of concrete, mostly in massive retaining walls. It also involves the removal of about 200 old buildings which occupied the area added to the yard; the relaying of a great number of gas and water mains, electric conduits, sewers, etc., which were encountered in making the excavations; the underpinning of buildings close to the excavation and the location and management of the contractors' plant and operations so as to avoid interference with about 1,300 train movements every 24 hours on week days and about 575 train movements on Sundays and the handling through the tunnel on the main tracks required for this constant service of the great quantities of bulky materials.

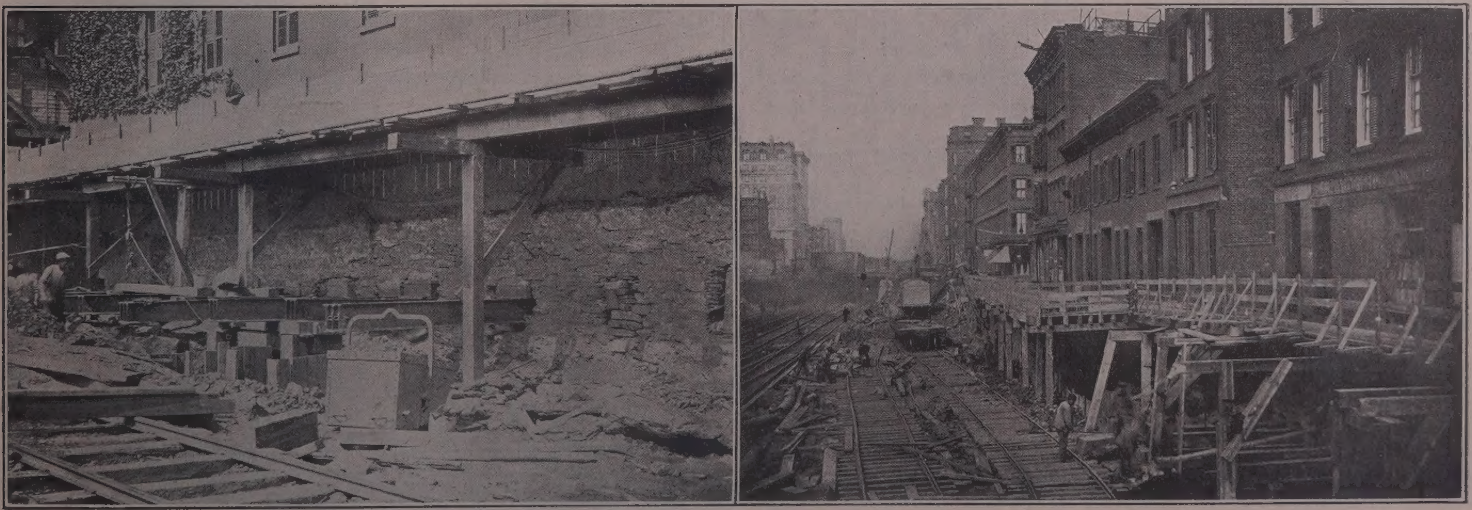
From 57th to 50th Sts. the excavation for the new yards is wholly in Park Ave. and extends the entire width of the street, involving the removal of part of the old tunnel structure and underpinning many adjacent buildings. At 50th St. the excavation extends to Lexington Ave., which it follows to the new station building at 43d St. On the opposite side of Park Ave. the excavation is gradually widened from 50th to 48th Sts., and thence to 45th St. has a full width extending nearly to Madison Ave. The average depth of the excavation is about 22 ft., except for the low level tracks which are at a maximum depth of 50 ft. below the old yard. A portion of the yard at the corner of 50th St. and Lexington Ave. is reserved for the transformer station, boiler house, express buildings, stores and offices; the rest of the yard is devoted entirely to tracks, of which there will be about 47 at the upper level and 28 at the lower level.

The preliminary work consisted chiefly in removing and shifting gas and water mains and building new ones, in removing the buildings on the site of the yard extension, in removing some of the old transverse bridges, and establishing some of them in new positions, and in relocating and readjusting much of the switch and signal plant. It was estimated that about 25 miles of pipes and sewers had to be removed or replaced and about 10 miles of this work was accomplished before general excavation was commenced in the main yard. A collecting sewer was built in Park Ave. from 49th to 54th Sts., intercepting the old sewers, which previously existed on nearly all the intervening streets, and delivering their flow to a new 4½x3-ft. sewer built in tunnel across Park Ave. under the depressed tracks and with a drop manhole at the upper end and a straight grade to its intersection with the existing Third Ave. sewer. Other sewers intersecting the yard excavation were cared for by a new sewer from Madison Ave. and 48th St. to Lexington Ave. and 42d St. It has inside dimensions of 28x42 in. to 36x54 in. and is built entirely of brick, being constructed in open trench except on 42d St. and Vanderbilt Ave., where it was tunneled.

The new yard work has been simply planned in successive steps; first, widening the Park Ave. tunnel on opposite sides alternately and expanding the four tracks there to ten, so as to give increased facility for the regular traffic and provide for the contractors' trains; second, establishing a yard for the contractors' plant and operations on ground near Lexington Ave. previously occupied by buildings now demolished; third, excavating for the depressed yard between Park and Lexington Aves., building retaining walls and laying new tracks; fourth, transferring the station traffic to these new tracks, excavating for the depressed yard between Park and Madison Aves., building retaining walls and finally laying new tracks there and opening them to regular service; fifth, erecting the steel viaduct for Park Ave. and for intersecting streets south of 57th St.; sixth, building the new station.

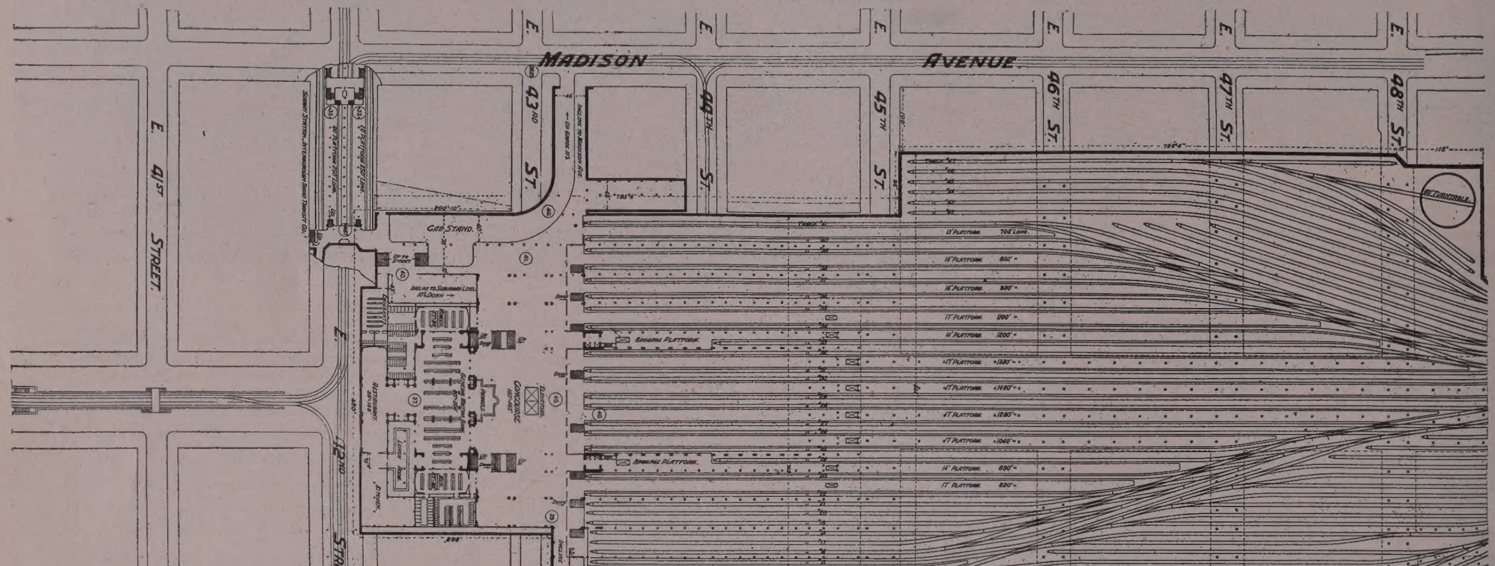
About Sept. 1, 1903, work was commenced for the first step by excavating on the west side of Park Ave. alongside the wall of the old tunnel from 50th to 57th Sts. This excavation was carried down at first only to the bottom of the tunnel and two new tracks, called 7 and 8, were laid in it and connected at both ends to the adjacent old tracks. The new side wall was built and, wherever necessary, the adjacent buildings were underpinned with temporary needle-beam supports and new concrete footings. As the excavation here and on the opposite side of the tunnel extended across the full width of the street to the building lines, the sidewalks were carried over the excavation on temporary wooden trestles.

The tracks in the old tunnel were formerly numbered 1, 2, 3 and 4, commencing at the east side; eventually there will be three additional tracks on each side making ten in all, numbered from the eastern new track so that the numbers by which the old tracks will be designated will be changed to 4, 5, 6 and 7, and the three new



Views Illustrating Methods of Underpinning Buildings and Supporting Sidewalks on Park Avenue.

east side tracks will be 1, 2 and 3. During the second year the contractor turned over to the railroad company tracks 5 and 6 and was given in return the use of old track 1 for his spoil and material trains.



Track Plan at the Express Level, Grand Central Station Improvements.

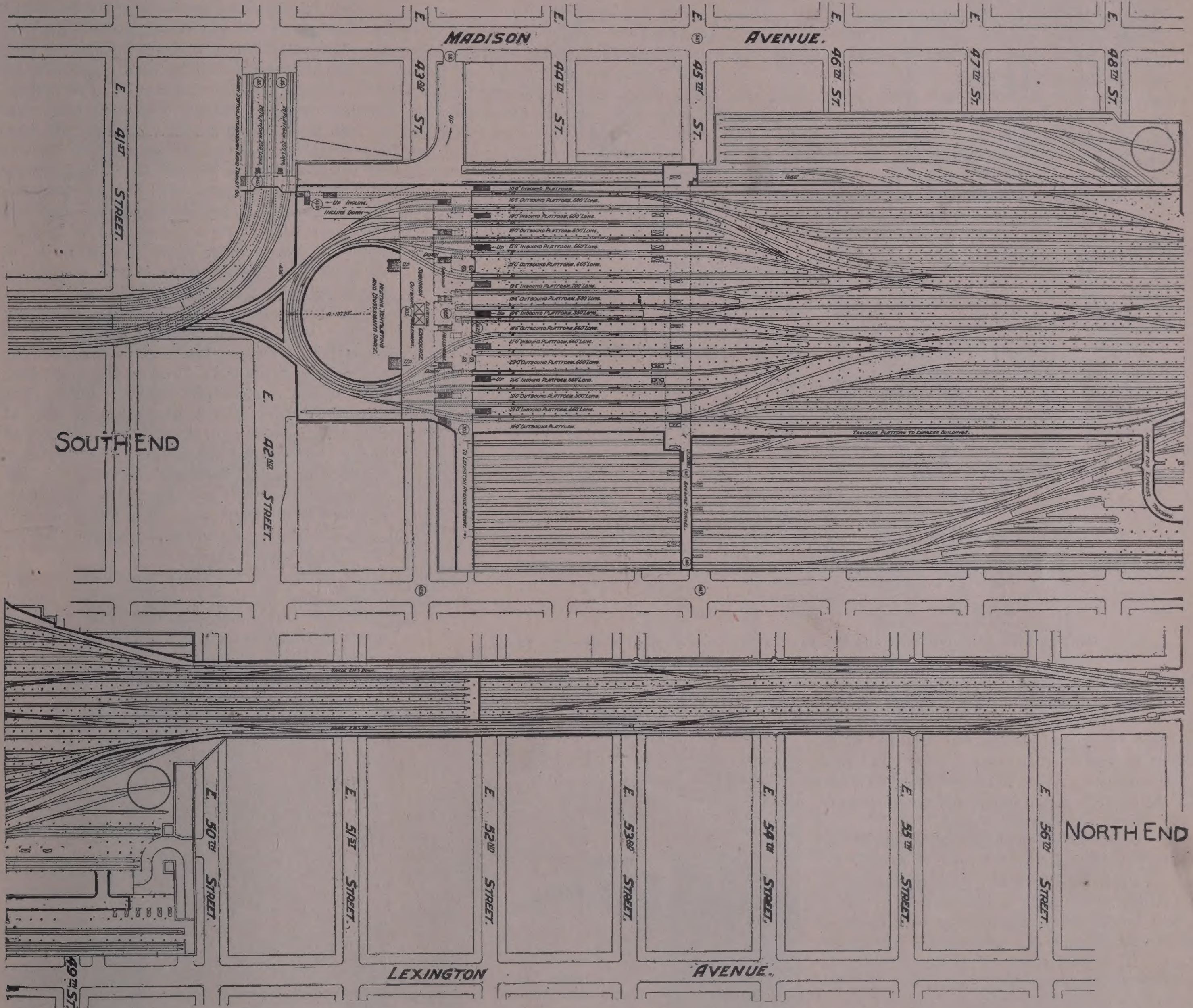
In 1904 work was commenced on the excavation on the east side of Park Ave., from 50th to 57th Sts., where a trench wide enough for new tracks 1, 2 and 3 was carried down to final grade. This excavation was in rock dipping so steeply toward the west that it was necessary to build a heavy retaining wall outside and independent of the new tunnel wall and to provide new footings for most of the buildings at a depth of 4 ft. below sub-grade. At 57th St. the old stone and brick masonry side wall and arch roof tunnel construction for the four-track service was changed to a rectangular construction similar to that of the standard Rapid Transit Subway, with bents of steel columns and roof beams 3½ ft. apart, with vertical and horizontal concrete arches sprung between and enclosing them for the walls and roof.

Normally the reconstructed tunnel has steel and concrete walls about 135 ft. apart, on the outsides of tracks 1 and 10 and one row of longitudinal intermediate columns between tracks 3 and 4 and another row between tracks 7 and 8. Tracks 4, 5, 6 and 7, corresponding to the original four tunnel tracks, will be in open cut except where covered by the street crossing bridges; tracks 1, 2 and 3 and tracks 8, 9 and 10 will be covered by steel girder and concrete flat roofs supported on their respective side walls and rows of columns to carry the sidewalk and a portion of the street on each side of Park Ave. Where, however, there are crossovers connecting the four old tracks to the six new ones, many of the intermediate columns must be omitted for clearance, and to allow this the side roofs are supported in some cases by longitudinal girders up to 130 ft. in length and between 56th and 57th Sts., by two riveted trusses 150 ft. long, 10 ft. high and 26.5 ft. apart on centers.

The walls of the old tunnel were partly removed, its roof was entirely removed and steel columns to carry the trusses were erected by derricks and temporarily braced. The trusses were then erected on temporary timbers supported by the old walls, the members being assembled by a stiff-leg derrick moving on top of the old tunnel. The trusses will eventually be enclosed by screens of ornamental concrete work concealing them from the street, and the space between them will be left open to the sky to admit light and air to the tunnel. At this point the east side of the trench required heavy sheeting which was braced by transverse timbers and kneebraces engaging the lower chord of the east truss. The stresses from these members were carried across the full width of the excavations and tunnel and transferred to the opposite side of the trench by a system of successive overhead braces which cleared the tracks and did not interfere with train service, as ordinary bracing would have done.

The 45-ft. excavation on the east side of Park Ave. has permitted the first intermediate row of columns to be set east of old track 1, and the roof to be built over new tracks 1, 2 and 3. Next excavation to sub-grade will be extended 45 ft. farther west, under old tracks 1, 2 and 3, new upper tracks 4, 5, 6 and 7 will be laid in permanent positions, new lower tracks will also be laid, the columns will be erected between tracks 7 and 8 and the roof will be built to them. Finally, the excavation will be carried down to sub-grade to the west retaining wall, tracks 8, 9 and 10 will be laid permanently and the roof completed.

In July, 1904, excavation was commenced south of 50th St., on the east side of Park Ave., in the new yard from which the buildings had been removed, and in June, 1905, work was commenced on the massive retaining walls A little later work was commenced on the sub-station at the northeast corner of the yard, and it is expected that in 1906 this part of the yard will be completed and its tracks laid to receive all the traffic from new tunnel tracks 1, 2 and 3, and passengers will be brought to a temporary station which will have been built between 44th and 45th Sts. for use in connection with other offices now located in the Grand Central Palace Building. This will allow the removal of the tracks in the present yard and the excavation there and later in the west part of the extension, so as to complete the new yard. At the same time the present 42d St. station will be entirely abandoned, torn down and replaced by the new terminal building indicated in the accompanying drawings.



Track Plan at the Suburban Level, Grand Central Station Improvements.

On Nov. 1 the total estimated quantity of excavation was about three-tenths completed, about one-tenth of the concrete was laid, about one-thirtieth of the steel was erected and the contractors' force averaged 700 men. The methods and plan of excavation on the east side of the yard are substantially the same as described in The Engineering Record of March 5, 1904, but some changes have been tried in the system, especially in dividing the excavation into two general sections instead of three, as at first intended, and then back to three again, and in additions to and modifications of the plant.

Earth has been excavated by hand and loaded by steel buckets and traveling derricks and by steam shovels delivering directly to the spoil trains. All rock has been blasted and much of the shattered portion has been loaded on cars by the steam shovels. Where the excavation was about 22 ft. deep it was generally made in three shovel lifts each one making a trench about 30 ft. wide. The shovel tracks are usually run north and south and are paralleled by the standard gauge tracks for spoil cars. There are two Marion shovels with 5-yd. buckets, one 70-ton Bucyrus shovel with a 3-yd. bucket and one 60-ton Marion shovel with 2½-yd. bucket. In October, 1905, the combined work of all four shovels was 50,000 cu. yd. Spoil is loaded by the derrick and steam shovels and deposited on 200 special flat cars, manufactured by the American Foundry Co. and the South Baltimore Car Co. These are hauled by five switching locomotives and two larger road locomotives drawing them through the tunnel and to various points where fills are being made by the railroad company, and are unloaded by plows operated by steam power. There are also a large number of Goodwin steel side-dump cars of 30-yd. capacity. A number of of stiff-leg derricks equipped with Lidgerwood hoisting engines have been used on different parts of the work, and two of them were mounted on movable timber frameworks. There are also four locomotive cranes made by the Browning Engineering Co., which have 45-ft. booms and a capacity for a 30,000-lb. load at 10 ft. radius.

Very little ground water has been encountered and no difficulty has been experienced in handling the surface water by 15 single-acting Cameron pumps and a few large Worthington pumps. About 100 Rand rock drills have been used and are operated by compressed air delivered through a 6-in. branch on the east and another of the west side of the yard. These branches supply also the hoisting engines, pumps, and most other machinery except the steam shovels, locomotives and concrete machinery, and receive air at 100-lb. pressure through a 10-in. main from one Rand and one Ingersoll compressor, each with a capacity of 5,000 ft. per minute, which are installed in the contractors' power plant at the foot of East 41st St. There are five Ransome concrete mixers operated by compressed air, and one operated by a General Electric motor. The smith shop, machine shop and repair shop, now temporarily located in the east extension of the yard, are equipped with an 800-lb. steam hammer, a drill press, ordinary hand and machine tools and drills, hammers and other tools operated by air pressure.

The design and execution of the Terminal Improvement work described above is under the direction of a special engineering corps of the New York Central & Hudson River R. R. Co. under Mr. W. J. Wilgus, vice-president. Mr. A. B.

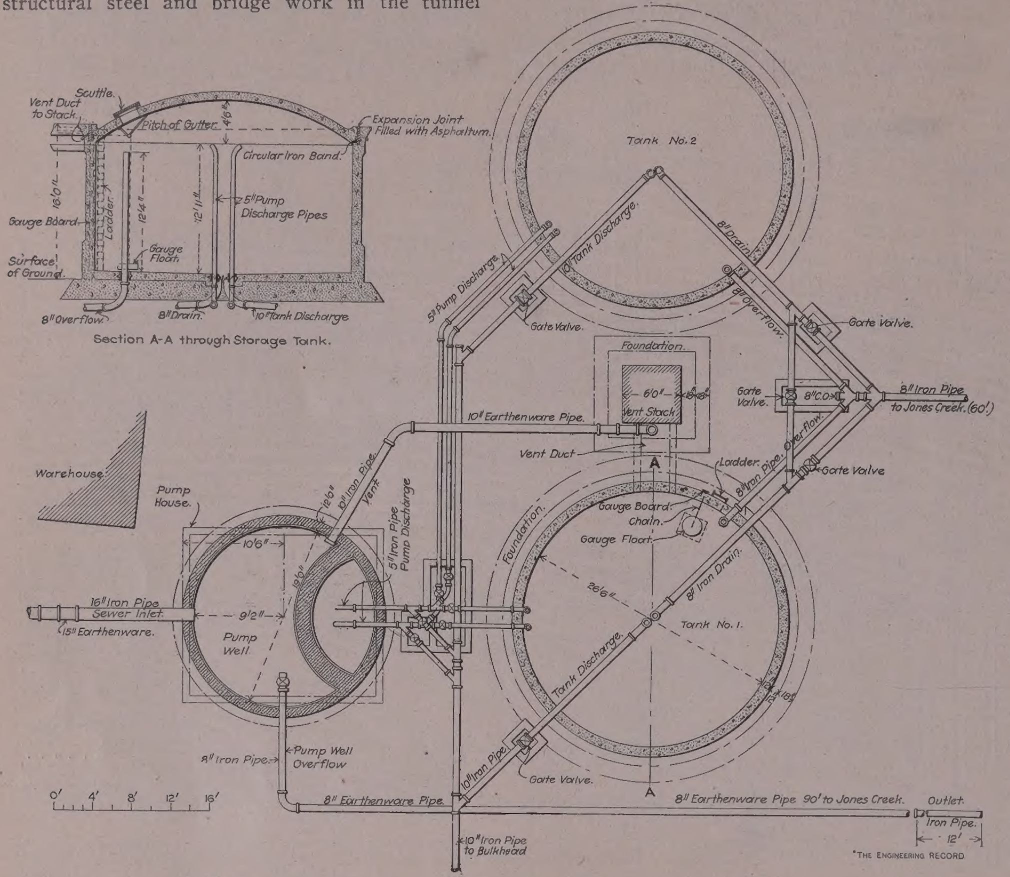
Corthell is terminal engineer; Mr. G. A. Harwood, designing engineer; Mr. W. F. Jordan, resident engineer in charge of general field work with Mr. W. L. Morse as his assistant engineer.

The contractor is the O'Rourke Engineering Construction Co., Mr. John F. O'Rourke, president, and Mr. Oscar Erlandsen, chief engineer. Sub-contracts were awarded for the Madison Ave. sewer to Mr. James Pilkington and for the water and gas pipe work to Norton & Dalton. The structural steel and bridge work in the tunnel and viaducts was let to the American Bridge Co. and to the McClintic-Marshall Co., and the erection to the Terry & Tench Construction Co. The contract for the sub-station was awarded to the Butler Brothers Construction Co., Mr. Olaf Hoff, chief engineer. Atlas Portland cement is used for the concrete in the tunnel and retaining walls.

A Turbo-Generator Unit of 2,000-kw. capacity is being built by the General Electric Co. for the Boston Elevated Ry. It is interesting because, like all the units in this company's stations, it will furnish direct current, and will be one of the largest machines for such service ever undertaken. Its normal speed of 750 r.p.m. makes the problem of armature construction and commutation one of no little difficulty, and the operation of this unit deserves to be watched carefully. At 180-lb. steam pressure, 100° superheat and not over 2 in. absolute back pressure, the steam consumption is guaranteed not to exceed 19.6 lb. per kilowatt-hour at 1,000 kw. output and 18 lb. at 2,000 kw. The selection of a direct-current unit of this size for a railway power station is not so strange in the case of the Boston system as it would be in the other plants, for the company's method of supplying power from a group of connected plants has proved decidedly successful. Incidentally it might be pointed out that the new turbo-generator will have an unusually severe test afforded by comparison with a 2,000-kw. station of the company equipped with reciprocating engines, which is furnishing power for 0.759 cent per kilowatt-hour, although coal costs $3.50 per ton.

The Sewage Pumping Station at the Hampton Institute.

The sewerage system of the Hampton Institute, Hampton, Va., is designed to serve a population of 1,000 people who live and work in a number of separate buildings scattered over a considerable area. The Institute is on Hampton River, a small tidal stream, and the land on which it is built is at most not more than 10 ft. above high tide, necessitating the entire flow from the sewerage system to be pumped. The ground water level is about 2 ft. below the surface during most of the year, which required the sewer pipe joints to be made with special care and occasioned much difficulty in all of the construction work. The drainage system consists of a 12 and 16-in. main, about 1,750 ft. long, laid toward one side of and across the roughly square tract on which the buildings are situated, with laterals reaching out on both sides from it to the various parts of the grounds. The water supply of the Institute is partially from local wells and, to avoid any danger of their pollution by leakage from the sewers, cast-iron pipe with lead joints was used in proximity to the wells, although the level of the ground water was considerably above the level of the sewers. Vitrified terra cotta pipe, with extra deep spigots and cement joints, was used in the remainder of the work.



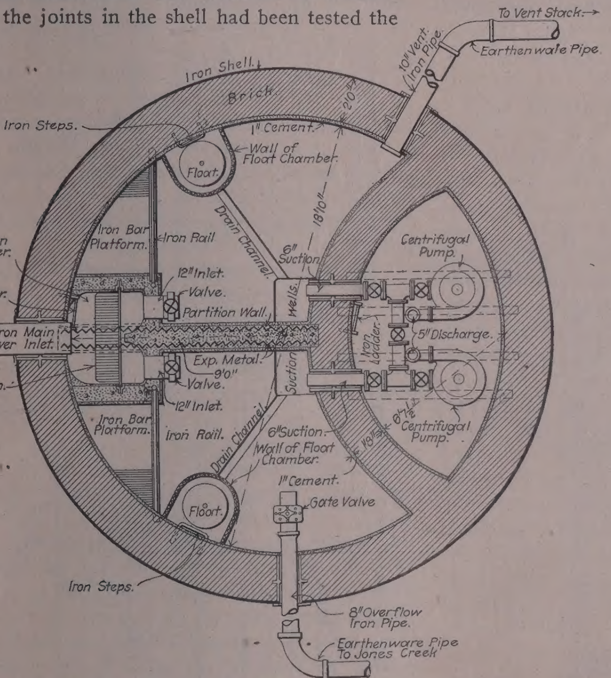
General Plan of Pump Well and Storage Tanks; Cross-Section of Storage Tanks.

The main sewer discharges into a brick and concrete pump well about 1,000 ft. from the river on the bank of Jones Creek, a small inlet from the latter. The sewage is pumped from the pump well to either or both of two covered reinforced-concrete storage tanks and discharged from them at high tide through a 10-in. cast-iron pipe leading along the bulkhead on the creek to the end of a dock extending into the river. The general arrangement of the pump well, storage tanks, the piping connections and a ventilating stack between the tanks is shown in accompanying illustrations. The circular pump well is 19 ft. in diameter on the inside and 17 ft. 4 in. deep at the lowest point of its floors. It has brick side walls and a concrete floor and is built in a sheet-steel cylinder with a steel bottom. The interior is divided in a screen chamber, two sewage wells and a pump chamber as shown on the detail plan. The sewage is dicharged from the main sewer through a coarse screen into either or both of the sewage wells and pumped from them into one or both of the storage tanks by two electrically-driven 5-in. horizontal centrifugal pumps arranged in duplicate at the bottom of the pump chamber in the pump well. The pumps are designed to operate automatically, but their operation may also be controlled by hand.

The pump well and tanks were built at some distance from the river in order to obtain a good foundation and at the same time bring the plant closer to the steam supply used as an auxiliary in the operation of the pumps. The steel shell of the pump well was sunk as an open caisson, the bottom plate being omitted, with the exception of an annular shelf, 2 ft. 6 in. wide, on which the brick walls are built, until the shell was in place in the ground. The shell was erected on

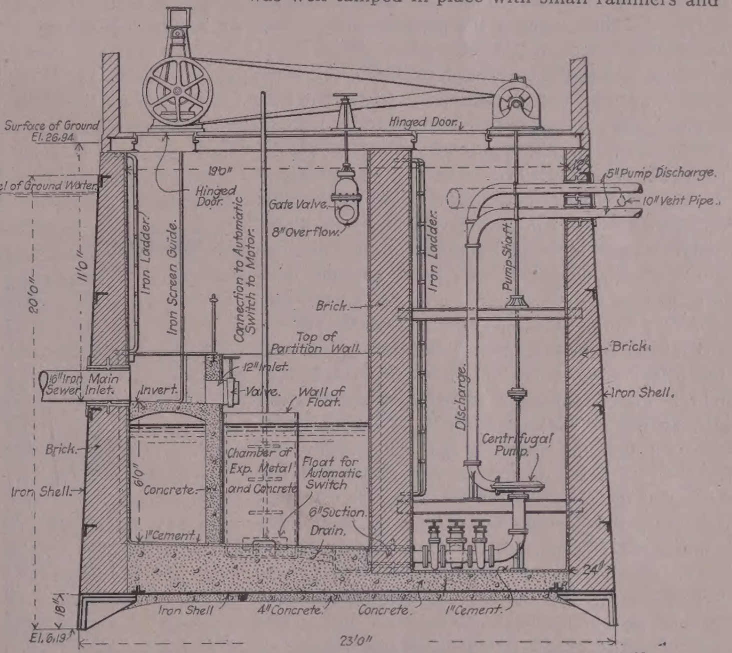
The Storage Tanks and Ventilating Stacks.

the surface before excavation was begun. As the excavation was carried down the shell, being provided with a cutting edge and weighted, settled in position, the ground water being kept down by pulsometer pumps. When the lower edge of the shell reached the required depth the bottom plate was riveted on and the joints thoroughly calked. The ground water was allowed to rise outside the well to test the tightness of the joints before the concrete floor was laid or the brick lining and the division walls were built, the shell being temporarily weighted and braced. The shell is battered 1¼ in. to the foot on its outer face to give additional resistance to the upward hydrostatic pressure due to the ground water level reaching within 2 ft. of the surface. As the difference between the weight of the entire pump well and this upward hydrostatic pressure was slight and allowed no factor of safety in the stability of the structure, the brick pump house over the well was built on a square grillage of I-beams resting on the walls of the latter and cantilevered over them at the corners.



Sectional Plan

Detail Plan of Pump Well.



Sectional Elevation

THE ENGINEERING RECORD

Detail Sectional Elevation of Pump Well.

After the joints in the shell had been tested the concrete floor was laid, the division walls built up in the well and the pump house erected. The walls of the pump chamber reach to the floor of the pump house and separate the chamber entirely from the remainder of the well, the pumps operating in the dry at the bottom of it. The pumps are in duplicate and each of them is direct-connected by a vertical shaft to a 15-h.p., 3-phase, 230-volt, 60-cycle, alternating-current induction motor on the floor of the engine room. The motors were made by the Westinghouse Electric & Manufacturing Company, and are arranged with special bearings for vertical operation. Each motor is started and stopped individually and automatically through the action of a float on the surface of the sewage in the well. The floats are protected from wave action by thin reinforced-concrete walls, with small screened openings at the bottom. Each float is attached by a vertical brass rod to a lever at the top of the engine room which actuates an automatic starting device for the motor that is similar to an electric elevator controller in its design and operation. An auto-starter for hand operation is also provided for each motor.

Electrical power is obtained from the generating station of a local street railway company, and, although the source is not subject to interruption a small vertical steam engine is provided in the pump house to drive one of the pumps in an emergency. Steam to operate this engine is obtained from the power plant of the Institute and the engine is belted to a pulley on an extension to the armature shaft of one of the motors. Provision is made for an additional engine, if required. To avoid the liability of the system being flooded in an extreme emergency the sewage wells are provided with an 8-in. overflow leading to the creek.

The only opening into the pump well below the ground water line is the 16-in. cast-iron inlet pipe sewer. This pipe was laid through a cast-iron sleeve built in the masonry wall with a flange on the outer end of the sleeve riveted to the steel shell and the joint calked. The sleeve has a circular lug on the inside at the middle and a circular flange imbedded in the masonry on the outside concentric with the lug. The joint between the sleeve and the cast-iron pipe is calked on each side of the lug with lead and yarn to render it water-tight. The other pipes which pass through the walls are in sleeves set in the same manner and the joints have all proved water-tight.

The floor of the engine room is made up of I-beams imbedded in concrete and rests directly on the outer walls of the well and the wall separating the pump chamber from the remainder of the well. The floor over the pump chamber is additionally reinforced to carry the motors with I-beams at right angles to the regular floor beams. The weight of the engine is largely carried directly by the walls. The brick pump house building is a one-story structure trimmed with stone and was built entirely by the negro and Indian students of the Institute.

The wells, pumping machinery and storage tanks are so arranged in duplicate and cross-connected that either pump may draw from either or both of the wells and discharge into either or both of the storage tanks. The pumps are also provided with connections through which they may discharge directly into the 10-in. outfall leading to the river. The storage tanks are cross-connected by an equalizing pipe to permit the capacity of both of them to be utilized if the pumps are discharging into one only.

The storage tanks are built entirely of reinforced concrete and are on monolithic concrete footings. They have an internal diameter of 26½ ft. and are 13 ft. 4 in. high in the clear at the springing lines of the flat circular arch domes which form their roofs. The tanks are 46½ ft. on centers with a reinforced-concrete ventilating stack 50 ft. high between them. Both tanks are connected above their high-water lines with the stack by ducts built in concrete and a 10-in. vent pipe from the pump well also connects with the stack. Two steam coils are placed near the bottom of the stack to induce an upward draft and to ventilate the pump well and the tanks.

The tanks are built above the ground and their contents can be drained entirely by gravity. They and the ventilating stack were designed to produce the most pleasing appearance the material would permit. A deep cornice molded in the concrete as it was laid was added at the juncture of the dome-shaped roof and sidewalls and the base of the stack made square to the top of the cornice. The base and top of the stack were molded to conform to the cornice of the tanks. The concrete was mixed wet in the proportion of 1 of Portland cement, 2 of sand and 4 of broken stone, with ½ in. as its maximum dimension. It was well tamped in place with small rammers and had an even surface as it came from the forms. The exterior surfaces of the tanks and stack were plastered and trowelled smooth, then given three coats of white water paint, rendering them quite smooth and uniformly white. The reinforcement of the tanks and stack were designed by the Concrete-Steel Engineering Co., of New York, and consists of various sizes of Thacher bars.

The discharge from each of the 5-in. centrifugal pumps is connected with a vertical riser which extends 12 ft. above the floor of the tanks with an eight-bend at its upper end to direct the discharge. The floor of each tank is sloped to a 10-in. cast-iron outlet pipe at the middle which connects with the discharge main leading to the river. An 8-in. cast-iron pipe at the same point forms a drain-out leading to the creek, the drain-outs of the two tanks being valved and cross-connected to serve as an equalizing pipe. An overflow is also provided on each tank. All of the pipe connections are controlled by hand-operated gate valves in valve boxes outside the tanks. Automatic valves governed by the tide water in the adjacent inlets which would discharge the contents of the tanks at high tide were designed, but the fact that there are men engaged in other work in the immediate vicinity who can operate hand-operated valves deferred the installation of the automatic valves for the present.

The pumps were required to have an economic capacity of 600 gal. a minute delivered into the storage tanks, the vertical height between the bottom of each suction pipe and the top of each discharge pipe in the tanks not exceeding 34 ft. They were also required to work under these conditions at an efficiency of 40 per cent. of the power delivered to the shaft, the duty to be computed by dividing the weight of water lifted to a height equivalent to the total head by the foot-pounds of power delivered on the pump shaft.

After the plant was completed the machinery was subjected to several tests to determine the capacity of the pumps and the efficiency of the pumps and motors under different conditions. The suction well, pump and storage tank toward the river are each numbered 1 and the corresponding portions of the plant farthest from the river are numbered 2, for convenience in speaking of these tests. Pump No. 2 driven by its motor under automatic control, drawing from well No. 2 and discharging into tank No. 1, pumped 3,542 gal. in 3 min. 40 sec., the motor consuming power at the rate of 15.0 kw.; the gauge pressure on the discharge pipe at the pump averaged 18.5 lb. and the pump ran at 800 r.p.m. Pump No. 1 pumping to tank No. 1 from well No. 1, when driven by its motor under automatic control, pumped 3,405 gal. against a total head of 18½ lb. in 3 min. 45 sec.; the motor ran at 825 r.p.m. and required 10.0 kw. to operate it. Pump No. 2 drawing from suction well No. 2 and discharging into storage tank No. 2 when driven by its motor under automatic control pumped 3,612 gal. in 3 min. 55 sec., aganst a total head varying from 18½ to 19½ lb.; the motor ran at 800 r.p.m., consuming power at the rate of 12.0 kw. Pump No. 1, drawing from suction well No. 1 and discharging into storage tank No. 1, when driven by its motor under automatic control, pumped 3,485 gal. against a total head of 18.25 lb. in 3 min. 50 sec.; the motor ran at 830 r.p.m., the total power rate being 11.0 kw. The combined efficiency of the pumps and motors was 52.0 to 73.3 per cent., the average being 63.7 per cent. Assuming the efficiency of the motors to be 85 per cent., the efficiency of the pumps alone is 61.2 to 85.7 per cent., with an average of 74.8 per cent.

The two storage tanks were filled with water and then the valves on the discharge outlets of both opened, the combined flow passing through the 10-in. outfall. The total capacity of the two tanks is approximately 100,000 gal., which they required 1.5 hour to discharge.

The reason for adopting the general plan of the pumping and storage plant described was to provide elasticity for future increase in the sewage flow. The portion of the plant underground is of sufficient size to handle many times the present daily flow of sewage. To increase the working capacity of the plant it will thus simply be necessary to build additional storage tanks on the surface of the ground, which can be done at comparatively small expense.

The sewerage system and pumping plant were designed by Mr. Albert L. Webster, consulting engineer, of New York, and the construction work was carried on under his direction. The sewers were laid and the pump well built by Messrs. R. H. Richardson & Son, of Hampton, Va. The mechanical plant was furnished and installed by R. D. Wood & Co., of Philadelphia. The reinforced-concrete tanks and stack were built by Mr. Robert A. Cummings, of Pittsburg.

An Electric Plant under construction at the summer home of Mr. Wm. B. Blackwell, near Morristown, N. J., has a 10-h.-p. Secor oil engine direct-connected to the generator, and 62 storage battery cells built by the General Storage Battery Co. The system operates at 110 volts and has a special voltage regulator for line regulation.

The Elastic Properties of Steel at High Temperatures.

A paper presented to the Royal Society by Prof. Bertram Hopkinson and Mr. F. Rogers.

Hitherto investigations into the elastic properties of metals have been confined to comparatively low temperatures. Gray, Dunlop, and Blyth have measured the modulus of rigidity and Young's modulus for wires up to temperatures of 100° Cent., and found that both these quantities decrease as the temperature rises. Martens determined the influence of heat on the strength of iron up to temperatures of 600° Cent., but his experiments were the ordinary tensile tests carried to rupture; and though he also found a substantial diminution of Young's modulus with rise of temperature, he did not go into the point fully, being mainly concerned with breaking stress and elongation.

In the experiments here described the elastic properties of steel and iron have been investigated at higher temperatures, ranging up to 800° Cent., and for stresses greatly below that required to rupture the material. We have found that as the temperature rises the stress-strain relations undergo a remarkable change, which may best be expressed by saying that what is variously called the "time-effect," or "elastische nachwirkung," or "creeping," increases greatly with the temperature. Steel at high temperatures behaves like india-rubber or glass; if it is stressed for a time, and the stress removed, it does not at once recover; but after the immediate elastic recovery there is a slow contraction perceptible for many minutes. Such "creeping" can be detected at ordinary temperatures, but at a red heat it attains a different order of magnitude, becoming (in its total amount) a substantial fraction of the whole deformation.

Fig. 1.

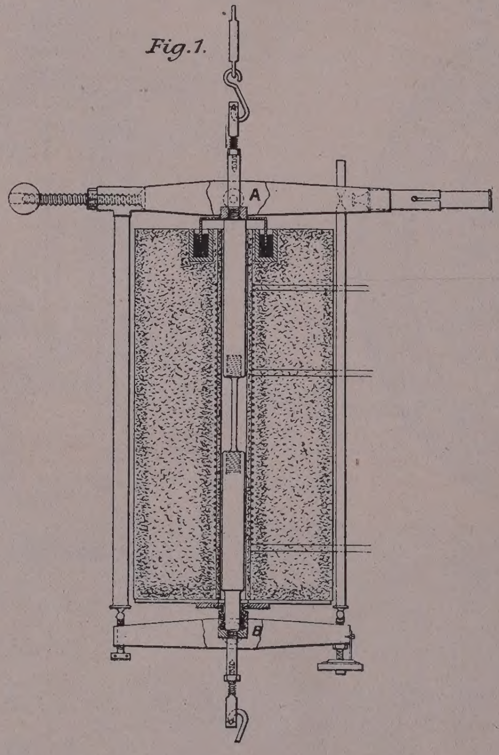


Fig. 3.

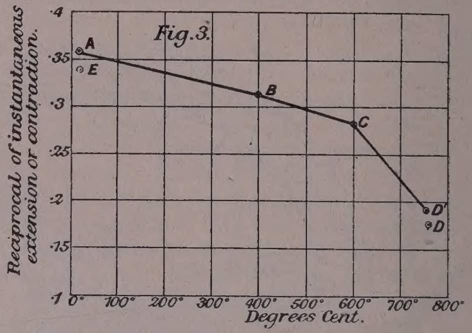
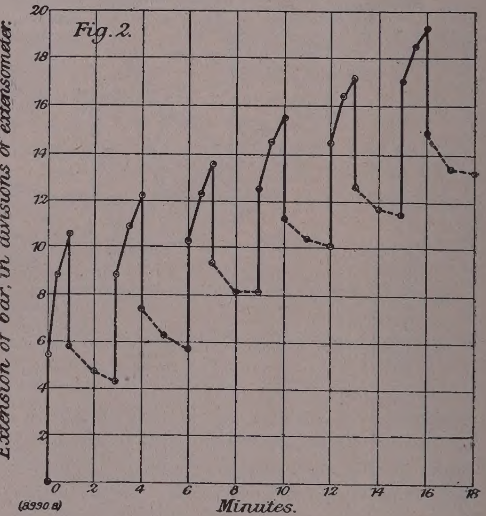


Fig. 2.



Diagrams Illustrating Paper on the Effect of Heat on Steel.

The test-piece was 4 in. long, about 0.2 in. in diameter, and had enlarged ends, which were screwed into two steel bars, each 1⅛ in. in diameter and 10 in. long. The whole was set up in a vertical electric resistance furnace, wound with three coils of nickel wire. The currents in these coils could be separately controlled, and in this way the temperature along the test-piece could be made very approximately uniform. The temperatures were measured by three thermo-couples, placed one at each end and one in the middle of the test-piece. Fig. 1 shows the apparatus with one side of the furnace removed. Changes in length between the points, *A*, *B*, could be measured correcting to 1/50,000 in. by means of an extensometer of Professor Ewing's pattern. The furnace was supported separately, and the test-bar, with the attached extensometer, was hung free within it. Tension up to 112 lb. (1½ tons per square inch) could be very rapidly applied or removed by means of a foot-lever at the lower end. The interior of the furnace was closed from the atmosphere by means of mercury locks, and the test-piece was kept surrounded by an atmosphere of nitrogen, so as to avoid oxidation.

It will be seen that the extension observed included the elongation of the end pieces as well as that of the test-piece. The area of the latter being one-thirtieth of that of the ends, and its length one-fifth, it appears that of the total extension 87 per cent. is contributed by the test-piece, and the remainder by the end pieces, if the elastic properties of the two are the same. At low temperatures this is approximately the case, but at higher temperatures the average temperature of the ends is less than that of the test-piece, and they, therefore, contribute a less proportion to the total extension. In stating the results in this paper, the total extension is alone referred to, and it is stated in extensometer divisions, each of which is 1/5,000 in., or one-twenty-thousandth of the length of the test-piece. It is probable that at high temperatures over 90 per cent. of this extension should be credited to the test-piece.

Two materials were tested, one being steel containing about 0.5 per cent. of carbon, and the other Low Moor iron.

Fig. 2 shows the result of a series of tests carried out on a steel bar at 750° Cent. The bar was at no time heated much beyond that temperature. It was loaded with 85 lb. for one minute, then unloaded for two minutes, and so on, and the curve shows the resulting changes of length in terms of the time. During the times covered by the dotted lines the bar was unstressed. It will be seen that even at this low stress (about 1¼ tons per square inch) the metal flows fairly rapidly, and that the overstraining has a considerable hardening effect, as shown by the diminishing amount of the permanent set produced by successive loadings. We found that this hardening disappeared with rest; that is, if the bar were left unstressed at 750° Cent. for a couple of hours after having been hardened by successive loadings, it was restored to its original soft state. With a slightly less load (about 79 lb.) the flow of metal was very much slower; the permanent set produced by load applied for one minute amounting to only about 0.5 extensometer division, against 1.5 divisions for the load of 85 lb.

In respect of all the features hitherto mentioned the properties of the material differ only quantitatively from those of the cold bar. Fig. 2 might, but for one remarkable difference, apply to a cold bar stressed to its yield-point. The difference lies in the behavior of the bar after the removal of the load. The cold bar does not contract appreciably; there is the instantaneous elastic contraction, then it stops. The hot bar, on the other hand, goes on shortening for two minutes or more after the load is off, as shown by the dotted line on the diagram, and the total amount of such shortening amounts to roughly one-third of the instantaneous contraction, or one-quarter of the total contraction, or one-fifth of the average total extension after hardening has taken effect.

The iron bar behaved in much the same way, but the metal flowed at a lower stress. There was considerable flow with a stress of but half a ton per square inch. The shortening after removal of load was also perceptible at that stress.

At 600° Cent. both bars exhibited greater tenacity. A load of 112 lb. (1.6 tons per square inch) applied to the steel bar for one minute produced an immediate extension of 3.8 divisions, followed by a slow drawing out which amounted in one minute to about 0.9 division. On removal of load there was an immediate shortening of 3.8 divisions, followed by a slow contraction amounting in two minutes to 0.7 division. The permanent extension produced was very small, if, indeed, there was any at all. The iron bar behaved in a similar way, but, as at 750° Cent., it yielded appreciably at a stress which was not sufficient to permanently deform the steel bar.

The experiment on the steel bar at 600° shows pretty conclusively that this slow recovery after release from stress is not solely, or even mainly, dependent on overstrain. It seems to exist to a large amount with stresses which leave practically no permanent effect; the strain develops slowly under application of stress and disappears slowly after it is removed.

This phenomenon is, of course, analogous to residual charge in glass and other dielectrics; the stress corresponding to the electric force, and the strain to the electric displacement. Whether the law of linear superposition of the effects of stresses—closely followed in the electrical analogy—is true for hot steel or iron, is an interesting question which our apparatus was hardly sufficiently delicate to answer.

The magnitude of this effect in steel may best be gauged by comparing it with other cases of the same kind—e.g., with the slow recovery of a glass fiber after twisting; if such a fiber be twisted through a considerable angle for several hours, it will recover all but one-fiftieth of the twist within two or three seconds of the removal of the stress. The remaining slow "creep," amounting to one-fiftieth of the whole deformation, corresponds to the slow return of the steel. In india-rubber, under certain circumstances, 10 per cent. of the strain disappears in time after the removal of the stress. But in steel at 600° Cent. the proportion is about 15 per cent.

The apparatus used was not entirely satisfactory, having been designed for the purpose of measuring larger strains than have been dealt with in this paper. The principal difficulty lay in the slow variations of temperature in the bar and end pieces, which could not be completely controlled, and which produced changes of length, masking to some extent the changes due to stress, especially when the latter were spread over considerable times. We cannot do more at this stage, therefore, than assert the existence of a large time-lag between the stress and the strain in steel and iron at temperatures of 600° Cent. and over; and the figures which we have given must be taken as indications of its order of magnitude only.

One effect of such a time-lag will be to cause dissipation of energy if the material be subjected to alternating stress, for it will lead to a difference of phase between the stress and the strain; and the amount of the dissipation will depend on the period of the oscillations.

Gray, Dunlop and Blythe found an increase in the rate of decay of the torsional oscillations of an iron wire as its temperature was increased to 100° Cent. On the other hand, Horton has found a decrease in the rate of decay under circumstances which were apparently the same, except that the period of the oscillations was very much less than in Gray's experiments. These results might be reconciled and explained by the existence of such a time-lag as we have observed at higher temperatures. With our apparatus we could detect no time-lag at temperatures lower than 400° Cent.; but it is quite possible that it exists to the small extent necessary to account for the decay of oscillations.

Another effect of "creeping," such as we have observed, is to make the determination of Young's modulus a matter of some uncertainty. Thus the extension of the bar at 600° Cent. produced by a given load varies 15 per cent. or more, according to the time of application of the load. When, however, the load is applied for a very short time—say of the order of one or two seconds—the strain produced seems to approach to a definite limiting value, which is the instantaneous extension or contraction of the bar observed in our experiments when the load is applied or removed. It seems reasonable to define Young's modulus for a metal in this state as the stress divided by this limiting instantaneous strain. It is then independent of the manner of loading, and is a definite physical constant; otherwise not. We have shown in Fig. 3 the relation between Young's modulus, so defined, and the temperature. The ordinate is the reciprocal of the instantaneous extension produced by the load of 112 lb. Owing to the effect of the ends, the reciprocal of the extension is not quite proportional to Young's modulus, their ratio being somewhat greater at high temperatures than at low, as already explained. With regard to this figure it should be noted that the error in the determinations on the cold bar, and at 400°, is probably not more than about 2 per cent. At higher temperatures the error is greater, as, owing to the rapid drawing out of the bar, it was difficult to be sure of the instantaneous extension. It is, however, fairly certain that the ratio of Young's modulus in the cold bar and at 750° Cent., as shown by the point *D'*, is not more than 10 per cent. in error. The points were observed in alphabetical order, and it was found that, in spite of our efforts to secure a neutral atmosphere, the bar had scaled somewhat after heating to 750° Cent. This accounts for the larger extension shown by the point *E*, which was taken in the cold after heating. After taking this point, the bar was taken out, cleaned and gauged, when its area was found to be reduced by about 6 per cent. Allowing for the reduced area, the points *E* and *A* are in good agreement; but, of course, there is some little uncertainty from this cause as to the position of the point *D*. If the full reduction of 6 per cent. in the area be allowed for, the corrected position is at *D'*, and this is probably not far from the truth.

In the iron bar the change of Young's modulus with temperature was of the same character, but greater. The value in the cold being taken as unity, that at 600° Cent., was about 0.6, while at 750° it was about 0.5.

Preservatives for Wood.

The price of lumber is increasing so fast that the matter of prolonging the life of timber in structures will soon force itself upon the attention of railroad managers. It is expecting a great deal of a preservative to indefinitely preserve timber that is unprotected from weather conditions, and at the recent meeting of the Association of Railway Superintendents of Bridges and Buildings this fact was emphasized in a discussion of preservative methods by Mr. J. P. Snow, bridge engineer of the Boston & Maine R. R. Nature provides for the decay and decomposition of timber when its circulation of sap is stopped. It is a difficult proposition to entirely counteract nature's laws; but their operation can be retarded and the life of timber prolonged by careful attention.

The ordinary wet and dry rot in timber is caused by the growth in the wood of a mycelium fungus. Its growth is not very unlike cancer in the human system. Its seeds or spores penetrate timber as soon as it is sawed and possibly while the trees are growing. They remain dorman if the timber is perfectly dry or if it is immersed in water or kept frozen. Warmth and moisture promote its growth. The action of the common preservatives is to poison the wood so that the spores do not germinate. To sterilize the timber and impregnate it so as to insure it for a long term of years against decay, is expensive; and it is doubtful if it pays under the present system of railroad maintenance, where radical changes occur every few years, which demand the renewal of structures from other causes than decay.

It seems to Mr. Snow that good judgment in the selection of timber and the partial protection of that most exposed, with a view to prolonging the natural life of the structure, say for one and one half the usual period, is likely to produce more beneficial results than the advocacy of costly preserving methods.

To begin with ties: In every lot there will be those which are not so good as the best, but too good to reject. These, including the sappy and open-grained ones, should be sorted out and used on the short bridges, or, if only one long bridge is being retied, should be put together at one end of the bridge, with the idea of their not lasting so long as the rest. A similar selection of trestle stringer timbers will result in prolonged life of the part made of better timber. We all know of the renewal of the whole of many structures on account of a few decayed sticks.

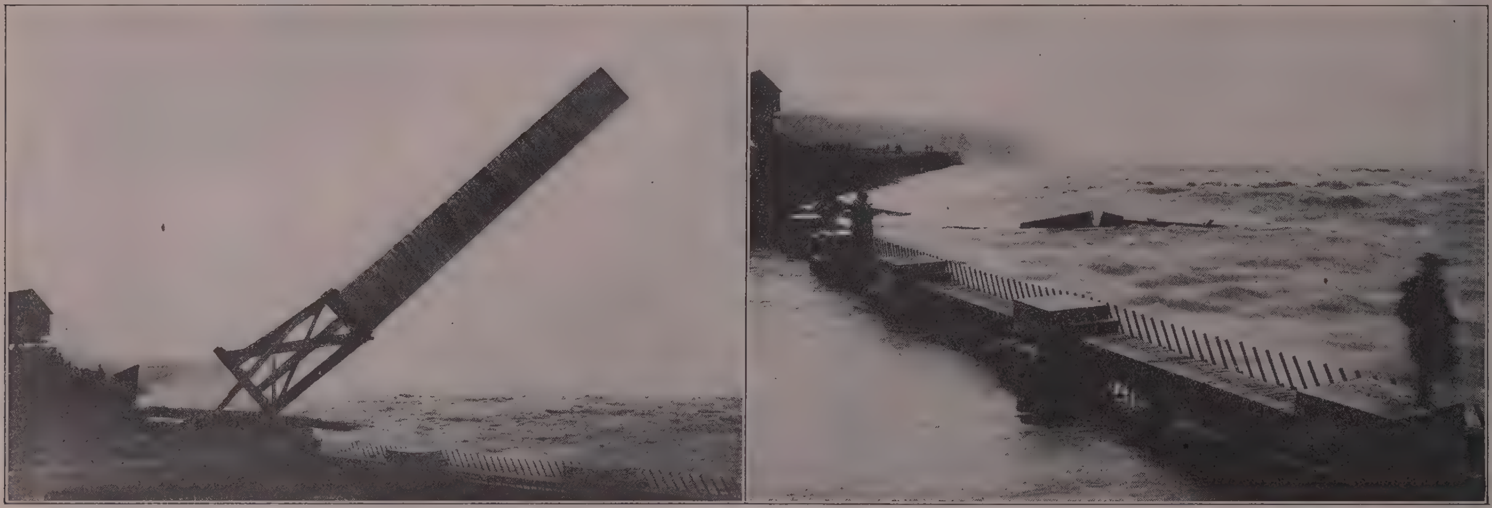
It is well known that timbers in a vertical position will last much longer than horizontal ones. On this account the posts of framed trestles will last much longer than the caps. If we cover the caps with zinc their life will be prolonged to match the posts. Horizontal timbers suffer much from sun checks, which serve as inlets for water, to feed the growth of the mycelium fungus. If the tops of such timbers are mopped with a penetrating, non-drying oil it will prevent much of this checking; and, if this oil is at the same time antiseptic and non-volatile it will do much to retard decay.

A wash that can be mopped on to timber after it is framed, that will do some good, is a great desideratum. It can be used with little cost and will be approved and allowed by the railroad management when more costly treating will not. Many such washes are advertised, but they are useless unless used with good judgment. Creosotes eat out iron and are wasted rapidly in the sun. Salts of many kinds are dissolvable in water and hence will be washed out by the rain. A solution of paraffin has been used to a considerable extent by the Boston & Maine road and the City of Boston on bridge planking which is covered with sand and paved. This has been removed in perfectly sound condition after 20 years' service. It, however, is not recommended for exposed timber, as the sun and rain destroy its efficiency. An emulsion of paraffin or other antiseptic oil that will spread easily, penetrate well, and neither dry up, wash out nor form a coating on the timber, is greatly to be desired.

A Novel Wing Dam.

By Orrin E. Dunlap.

The most unusual piece of dam construction Niagara Falls has witnessed is in connection with an effort of the commissioners of Victoria Park, Canadian side, to increase the depth of water in the joint intake of the Niagara Falls Park & River Ry. and the city of Niagara Falls, Ont. The city secures its water supply and the company takes water for the operation of turbines in its power station in the park from this intake. Many times in the past, especially since the power development on the Canadian side has been in progress, the city has been short of water, and it has been found necessary occasionally to call on the city of Niagara Falls, N. Y., across the river, to supply water by lines of fire hose stretched across the lower steel arch bridge. Both the city and company felt that the power companies were to blame for the shortage, and they so complained to the park commissioners, who consulted Mr. Isham Randolph of Chicago. He advocated the construction of a dam that would tend to stop part of the flow of water over the Horseshoe Fall, only a hundred feet below the intake, and back it up into the intake, where the depth would be increased. How to build it was a problem, for the point is right in the upper rapids of the Niagara, where the current is very swift, the river feeling the suction of the great waterfall close by. Mr. Randolph told the commissioners to erect on the river bank a column of concrete 50 ft. high, and 7ft. 4 in. square. It was to be built on trestle rising 20 ft. above the ground, so that when it was tipped over it would fall 15 or 20 ft. out from shore and leave an opening for an ice run between the end of the dam and the bank.



Views of the Concrete Column while Falling and after Settling in Place as a Wing Dam.

The commissioners followed this plan. The 1:3:5 concrete column was built inside of a framework, which was removed later. Every 8 ft. of its height a wooden wedge was inserted running half way through the column so as to break it up into six sections when it fell. These pieces were not to be left at the mercy of the current, for a chain weighing 800 lb. was run through the center to hold the sections in place. For more than a month the column was left drying in the sun and wind.

On the afternoon of Nov. 9, it was tipped over into the river in the presence of more than 1,000 spectators. Three powerful jacks were placed under timbers at the base of the trestle, and when all was ready these jacks were raised inch by inch. At first there was no perceptible change in the position of the column, and it was not until the jacks had been raised about 4 in. that the column was seen to leave the perpendicular. Five inches more of elevation, and the column leaned in a threatening manner. Suddenly it gained headway and plunged into the river, breaking into sections, as expected. The end near the shore is about 15 ft. out, leaving an ample ice run. Both ends are just under water, but at the center, the sections appear to have wedged one against the other and may settle down in time. As soon as the column was in the river, forming a dam, the water's rush toward the Horseshoe Fall was stopped to a considerable degree, and the depth in the intake was increased 10½ in., according to Supt. James Wilson of Victoria Park, who said this was about all that was expected. It is hoped that this increased depth of water in the joint intake will prove an ample supply.

THE COST OF COAL HANDLING at the station of the Boston Edison Electric Illuminating Co. is stated by Mr. Charles H. Parker to average 15.35 cents per ton from boats to bunkers, including repairs to machinery. The equipment consists of a tidewater pier with two unloading towers, an open storage yard, bunkers in the station, and conveyors driven electrically. The cost of handling the coal from lighters is 5.27 cents a ton, from barges 8.05 cents, from steamers 9.36 cents, and from schooners 15.04 cents. About one-half of one per cent. of the current output of the station is now used for running the coal-handling plant, but it is expected that this will be reduced by improvements now being made.

Escalators for Factory Employes.

An instance of regard for the comfort of employes that deserves attention is the decision of the American Woolen Co. to install four escalators in its new Wood worsted mills at Lawrence. This will be the largest woolen mill in the world, and the first factory to have these mechanical stairs for raising employes from one floor to another. The mill will employ about 5,000 hands when running at its full capacity, and the company estimates that the enhanced efficiency of the female employes due to an avoidance of stairs will more than offset the interest on the hundred thousand dollars invested in the equipment. It is also believed that these conveniences will attract the best operatives in the city to the mill.

The escalators are to be installed in a special building situated between the wings of the factory proper and adjoining and connected with the factory entrance, which is at the second floor. Two escalators will run "in parallel" from the second to the fourth floor, the intention being for the employes to walk down from the fourth to the third floor, or ascend by ordinary stairs from the second to the third floor. One escalator will run from the fourth to the fifth floor and one from the fourth to the sixth floor.

To distribute without delay to their respective floors so formidable an army of workers as will be housed in the new Wood mill will, naturally, require a tremendous elevating capacity. It is estimated that 100 ordinary elevators would be required to equal the equipment represented by four escalators. The latter will be run in a downward direction just prior to, and for a short time after, the noon whistle and in a similar manner at the closing hour at night, also in the event of fire or other panic. At all other times they will be run in an upward direction. The feature of instant reversibility and the fact that the escalator acts as a constant carrier without attendance will insure in the event of serious panic the delivery to the street level of any one who can reach or be helped to the escalator, even though such individual was unconscious during transit. It will be interesting to observe what will be the actual result of an escalator installation of this magnitude in a factory of this character from a "social welfare" point of view.

THE PETROLEUM INDUSTRY in this country in 1904 produced more oil than ever before, 117,063,421 bbls. of crude oil being the official record. The output west of the Mississippi was greater than that east of the river for the first time, and the demands for the light grades of refined oil for internal combustion motors have caused marked changes in the market conditions.

Sinking a Foundation Caisson with Post-Hole Augers.

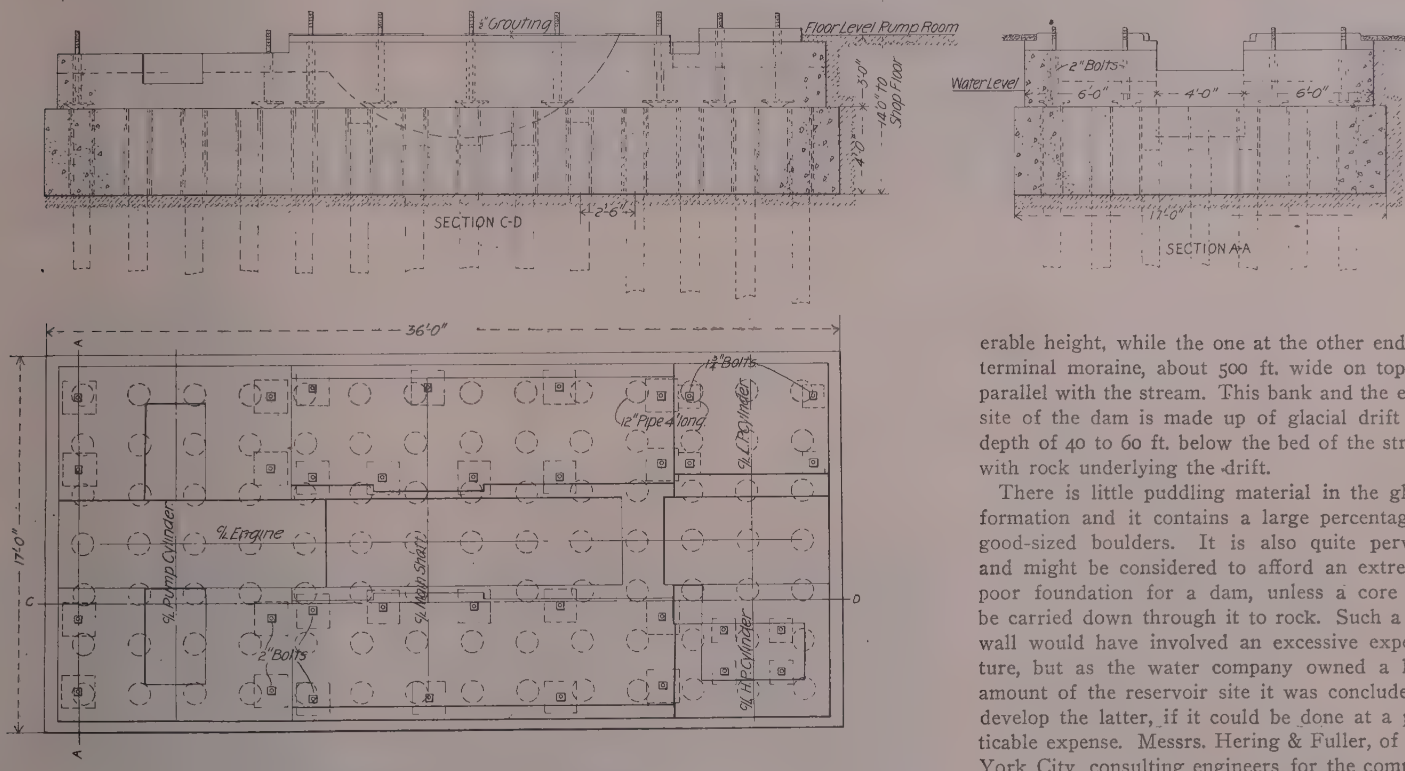
A horizontal cross-compound pumping engine of 6,000,000 gal. capacity was recently installed in the rear of building No. 13 of the General Electric Co., at Schenectady. It has cylinder and stroke dimensions of 20x44x16x36 in. and its 250,000-lb. weight is set on a 16x40-ft. pile and concrete foundation. About 24 ft. distant, in the clear, is a 200,000-gal. covered underground reservoir, 12 ft. deep below grade to footings, and in close proximity is a battery of large steam boilers and their stacks. The soil is quicksand covered with 3 ft. of dry clay and loam and 7 ft. of fill. The stack and boiler foundations go down to the water line 10 ft. below grade. The stacks are 120 ft. high, weigh 1,600 tons and have 39x39-ft. footings resting on quicksand.

In order to cut off the piles for the pump foundation below the ground water level and place a mass of concrete around their upper ends to form a footing, it was necessary to excavate the quicksand to a total depth of about 15 ft. below grade and nearly 5 ft. below water line. An open pit was excavated to the water line and in it was placed an open box or caisson 4 ft. high and of the full size of the footing, which was 16x40 ft. inside, a floor was laid in the bottom and 91 12-in. holes cut in seven transverse and fourteen longitudinal rows. In each hole was fitted a 12-in. vertical wrought-iron pipe 4 ft. long open at both ends. The caisson was then filled with concrete up to the top of the pipes. After this had set it was filled with pig iron piled as closely as possible between the pipes to a height sufficient to get about 3,600 tons, or 40 tons per pile. The men then commenced simultaneously at either end and the center of the box to bore the quicksand under it by means of three post-pole augers, each operated by two men, who worked back and forth from end to end of the transverse rows of the pipe, boring through each pipe in about five minutes to a depth of 1 ft. below the bottom of the caisson. After borings had been made in all the pipes, they were found to be filled up to the level of the caisson bottom by the quicksand, which gradually entered the holes from all sides, but did not rise in the pipes. The borings were repeated again and again as the quicksand was removed, and the caisson descended about 3 in. daily. Care was taken to keep the borings and the loading uniform and it settled horizontally, and in about three weeks reached the required position.

Piles between 11 in. and 12 in. in diameter at the top and 8 in. at the point were driven through the pipes to a distance of about 19 ft. below the bottom of the caisson and were cut off level with the tops of the pipes. The pipes were grouted, the caisson was filled with concrete, and the second course of concrete was built above it in the usual way, completing the foundation in about four weeks from the time at which it was commenced; three weeks being required to sink the caisson.

The work was done so carefully that no settlement or displacement was caused to the chimney or reservoir or any of the boilers, and the amount of sand removed by the augers was estimated not to exceed the displacement of the caisson. The work was conducted very cautiously and the boring was always stopped before there was any indication of displacement in the quicksand, and might probably have been made considerably deeper without trouble. The pipes were not necessary on account of the rising of the quicksand, but were effective in keeping the water out of the caisson.

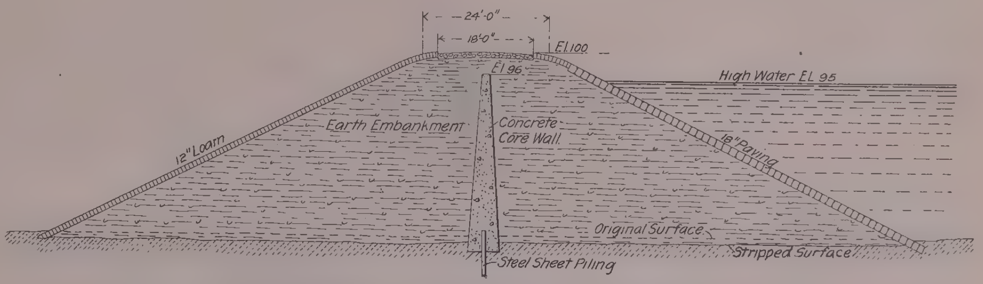
This foundation was designed and its construction directed by Mr. W. A. Pearson, engineer in charge of building construction for the General Electric Co., Schenectady.



Foundations Sunk with Post Hole Augers.

Sheet Steel Piles in Reservoir Construction.

The Hackensack Water Co. supplies a number of towns and cities in northeastern New Jersey with water taken from the Hackensack river at New Milford and pumped 22 miles to the reservoir of a mechanical filter plant at Weehawken. In order to conserve the flow at Pascack Brook, a tributary of the river above the intake, a reservoir with a capacity of 870,000,000 gal. has been built on the brook just above New Milford, at Hillsdale Manor. The site of the dam is at a point where the valley of the brook is about 1,600 ft. wide, with banks at each end of the dam which rise 40 ft. above the bed of the stream. The bank at one end continues to rise to considerable height, while the one at the other end is a terminal moraine, about 500 ft. wide on top and parallel with the stream. This bank and the entire site of the dam is made up of glacial drift to a depth of 40 to 60 ft. below the bed of the stream, with rock underlying the drift.



Cross-Section of the Hillsdale Manor Reservoir Dam.

There is little puddling material in the glacial formation and it contains a large percentage of good-sized boulders. It is also quite pervious and might be considered to afford an extremely poor foundation for a dam, unless a core wall be carried down through it to rock. Such a core wall would have involved an excessive expenditure, but as the water company owned a large amount of the reservoir site it was concluded to develop the latter, if it could be done at a practicable expense. Messrs. Hering & Fuller, of New York City, consulting engineers for the company, decided to strip the top soil from the dam site to a depth of 12 to 18 in. and drive interlocking steel sheet-piling down approximately to the rock; then imbed the top of the piling in the base of a concrete core-wall and build an earth dam.

Steel sheet piling, made by the Friestedt Interlocking Channel Bar Co., Inc., of Chicago, was used under the core-wall. It was delivered in 30-ft. lengths and driven to a depth of 35 to 50 ft., the lengths being spliced together on the ground, when necessary. Large boulders, which caused much trouble, were frequently encountered in the driving, and in a few places it was specially difficult to sink the piles. An ordinary land pile-driver, with a 2,000-lb. hammer, was employed, but in order to get the piles around the boulders two water jets had to be used. A 1,000,000-gal. Worthington pump was installed on the river bank and a 6-in. main laid from it the entire length of the dam. Connections for 2-in. hose were made on this main and the hose connected to 1.5-in. pipe, which was sunk in the usual manner of a water jet, one on each side of the pile as it was driven. In this manner it was possible to wash holes around boulders so they could be shoved to one side by the steel piling. When the boulders were too large for this treatment, the piling was deflected around the boulder, in one case going outside and around a boulder about 10 ft. in diameter. This method of driving was very successful, though rather slow. No attempt was made to cut off the piling at the top, they being left to project irregularly into the concrete core-wall as shown in the accompanying illustrations.

Pile Drivers and Water Jets Sinking Steel Sheet Piling.

The dam has a maximum height of 35 ft. and is 1,600 ft. long at its crest, 1,200 ft. of which is straight and the remainder at one end is on an 11° curve. It is 24 ft. wide on top, with 1 to 2 slopes on both up-stream and down-stream faces. The concrete core-wall extends 2 ft. below the surface of the stripped site. It is 5 ft. wide at the base and is battered on both faces to a width of 18 in. at the top, which is 4 ft. below the crest of the dam. The earth embankment was built of 6-in. layers of material similar to that in its foundation, except that the larger boulders were removed. The material was placed by wagons and wheel scrapers, depending on the distance from the dam at which it was obtained. The high-water level in the reservoir is 5 ft. below the top of the dam, and the up-stream slope of the latter is paved to 3 ft. above the water line with an 18-in. layer of cobble stones. The down-stream face is covered with a 21-in. layer of loam and will be sodded. A wasteway, 85 ft. wide, is built in concrete toward one end of the dam on a small natural hill which rises to the high-water level. The crest of this wasteway is at that level. An overflow channel lined with concrete laid on the natural surface extends from the wasteway diagonally across the down-stream slope of the dam and connects with the bed of the stream. An 18-ft. macadam drive is built on the crest of the dam, crossing the wasteway on a reinforced-concrete bridge. The outlet from the reservoir is a 48-in. cast-iron pipe laid through the bottom of the dam, the earth embankment being protected from wash by concrete wing walls at each end of the pipe. The flow through the outlet is controlled by two gates in the down-stream slope of the dam.

Dependence was placed entirely on the core-wall and sheet piling to prevent a flow of water through the material under the dam. Any water that might pass under the bottom of the sheet piling, or through the joints in it, was held to be subjected to such a loss of head, due to the excessive friction encountered in filtering through the soil for comparatively long distances, that the amount of leakage caused by the head of water in the reservoir would be slight. It was also considered that the voids in the material through which any such flow did take place, would soon become filled with silt carried by the stream. Observations taken after the reservoir was filled showed the slope of the underground water through the glacial drift to be about 5 ft. in 1,000 ft.; the slope produced by driving the sheet piling was changed to about 175 ft. in 1,000 ft.

The tracks of the Erie R. R. are on the opposite side of the reservoir bank formed by the terminal moraine from the dam, and are considerably lower than the high-water level in the reservoir. No sheet piling was driven in this bank, however, to prevent seepage through it, the friction offered to the filtration of water through the bank and the gradual silting up of the latter being depended on to hold the water in the reservoir. A 16-in. drain laid parallel to the railroad tracks, and between them and the reservoir bank, has been more than capable of carrying the seepage that has taken place through the bank.

The dam was completed and the reservoir filled in July. Four springs, which flowed fairly good streams and were made up practically all of seepage, developed below the dam soon afterward, but their flow began to diminish gradually. It is believed that most of this water ran around the ends of the dam, as the piling was only extended 50 ft. into the natural bank on each side. Careful weir gaugings have determined the total leakage from the reservoir to be less than 500,000 gal. a day. As this is less than the minimum flow of the stream and the reservoir was built to conserve its heavier flows, the object of the dam is accomplished. The saving made by using the sheet piling instead of carrying the concrete core-wall down to rock is estimated to be nearly $200,000.

Messrs. Hering & Fuller, of New York City, were consulting and supervising engineers for the Hackensack Water Co., on the reservoir work. The plans for the work were developed under the direction of Mr. W. B. Fuller, who also supervised their execution. The work was built by the company on a percentage arrangement with Mr. Myles Tierney, general contractor, of New York City.

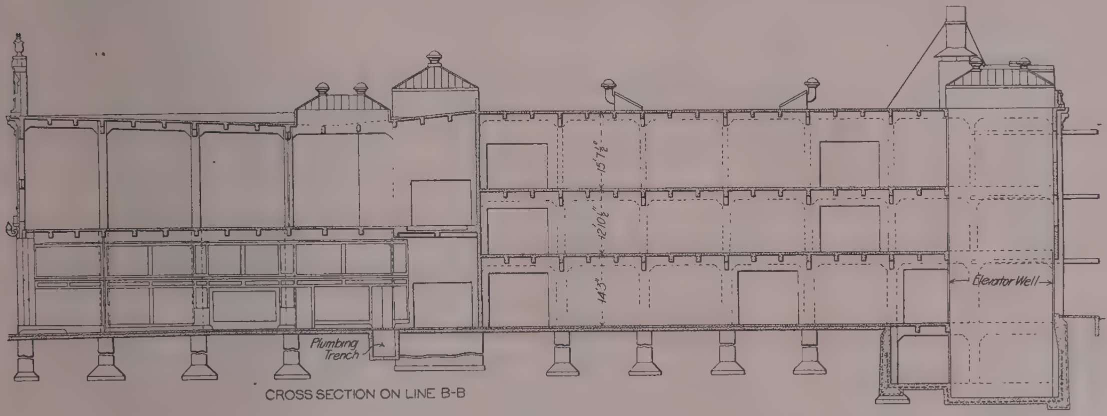
The Dam Site, Showing Driven Steel Sheeting with Core Wall at the End.

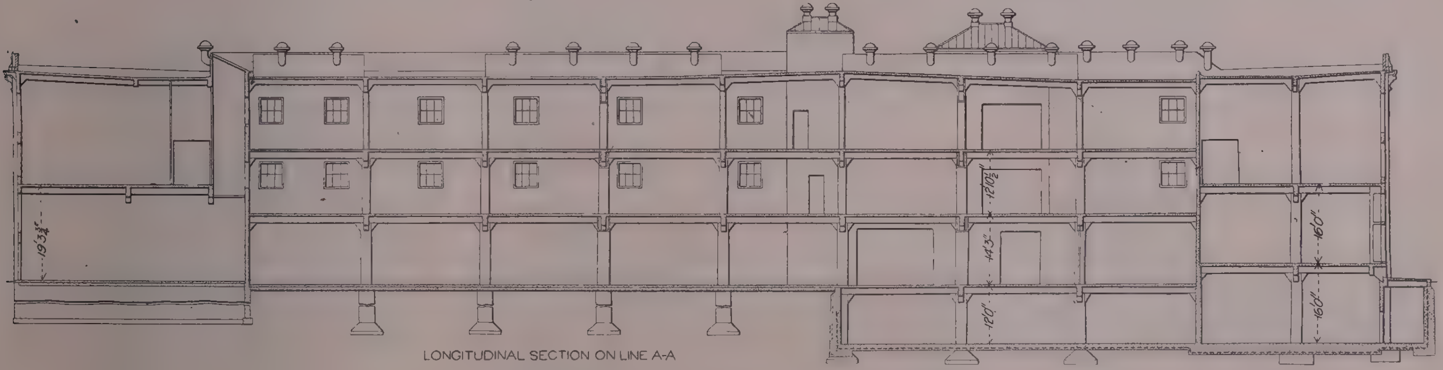
A LARGE MARBLE PLANT has recently been equipped for electrical operation, the Westinghouse type CCL alternating current motors being used. Although the service is severe, it is understood that an increase in production has been secured with a decrease in operating costs.

Reinforced Concrete Building for the Park Square Motor Mart, Boston.

By G. H. Brazer, Consulting Engineer.

A building for the storage and livery of automobiles and, in fact all sorts of motor vehicles, is now in process of construction at Park Square, Boston, Mass. This building covers an area of about 47,400 sq. ft., and consists of three floors and a roof. The first floor rests directly on the ground, except a small portion over a basement which is used for a boiler room, and the second and third floors and roof are supported on columns. The exterior of the building is principally glass and galvanized iron work. It has been the idea to make this building a purely reinforced concrete structure and as nearly fireproof construction as can be obtained. The floor space has been divided by means of 8-in. fire walls to meet the approval of the Board of Underwriters and Boston Building Department. All partitions are 2 in. thick, of Portland cement plaster on expanded metal.





Cross-Sections of the Park Square Garage in Boston.

In designing the building the following live loads were used: First floor, 250 lb. per square foot; second and third floors, 150 lb.; roof, 50 lb.; stairs, 70 lb. All parts of the building were proportioned for these loads. The unit strains used in calculating the various parts of the structure were as follows: For the columns, 600 lb. per square inch compression; for shafts of column footings, 500 lb. per square inch compression; for compression flanges of beams and girders, 375 lb. per square inch; for extreme compressive fiber strain in slabs and all rectangular sections, 550 lb. per square inch; for shear on plain concrete, 30 lb. per square inch, and 100 lb. where shear reinforcement is used. The unit strains for steel are 16,000 lb. per square inch tension (this unit being reduced, in calculating rectangular sections, when the percentage of steel ran above 1 per cent., in order not to exceed the extreme fiber strain on the concrete), and 5,000 lb. per square inch compression. All beams and girders, which could be considered as tee or angle sections were calculated as such. The load per square foot on the soil (which was blue clay) was taken as 4 tons.

In calculating the slab it was considered as a continuous beam and the reinforcement was placed near the top surface over the beams and near the bottom surface halfway between the beams. The beams were considered as tee or angle sections wherever it was possible and the girders also, but on the girders it was necessary to run the reinforcement of the slab transversely, thus making the slab act as a cantilever on either side of the girder, for a width required for the flange, in order that the fiber strains from the slab action should not add to that of the tee section of the girder.

The foundations were of a somewhat novel character which proved to be economical as well as capable of rapid construction. The site for the building is on made land, there being about 12 to 15 ft. of fill and silty material before the blue clay was reached. The footings were 3 ft. cylindrical shafts with enlarged bases, running from 5 to 8 ft. in diameter. The method of constructing these footings was as follows: An excavation was made about 3 ft. in diameter and about the same depth, into which a cylindrical iron tube 3 ft. long, in two segments, was placed. These segments are made with flanges turned in and bolted together, with a tapered wooden plank in between flanges, which, when removed, allows the tube to collapse. The excavation is then carried down another 3 ft. and another section of tube set; this operation is continued (one man doing the excavating) until the shaft has penetrated the clay at least a foot. The enlargement is then commenced, running out from the vertical at about an angle of 45 deg. and carried down on this slope until the required area of base is obtained. The concrete is then immediately filled in, removing each section of tubing just previous to the laying of concrete in that section. All footings were of 1 :2½ :5 concrete and are carried up to within 6 in. of the first floor. Four ⅞-in. rods 6 ft. long were set into the tops of all footings, these rods projecting about 3 ft.

The exterior columns were made rectangular and, with the exception of those at the corners, were 13 x 25 in. for the first story, 13 x 18 in. for the second story and 13 x 15 in. for the third story, the outside faces being flush. These columns are all reinforced with four ⅞-in. rods set in from the faces about 3 in. In addition to the vertical rods there are hoops of ¼-in. rods, with their ends hooked together, spaced at intervals equal to the diagonal distance between the vertical rods.

The interior columns are all 23 in. in diameter in the first story, although recourse had to be taken to figuring the steel as taking a portion of the load in order to maintain this size. The strain allowed on the steel was in proportion to the ratio of the moduli of elasticity of the steel and concrete, which was taken at 8¼, this being arrived at from experiments by Prof. Lanza, of the Massachusetts Institute of Technology. As the allowable strain on the concrete for columns was 600 lb. per square inch, the above ratio of 8¼ would give an allowable strain on steel of 4,950 lb. per square inch. The largest rods used were 2¾ in. in diameter and four in number. At the base of the columns, which were heavily reinforced, there was placed a large cast-iron plate to distribute the load from the reinforcing rods to the shaft of the foundation. In the second story, it was decided to do away with the heavy reinforcement, as the heaviest loaded column required only a 23-in. diameter concrete section. The majority of the second-story columns, however, were only 18 in. in diameter, while those of the third story were reduced to 12 in. diameter. All of the interior columns, except those reinforced with large rods, were reinforced vertically with four ⅞-in. diameter rods set 3 in. in from face and hoops of ¼ in. diameter spaced at intervals equal to the diagonal distance between the vertical rods.

The forms for the interior columns are of galvanized iron with 2 x 1-in. wooden staves bound by adjustable iron hoops spaced about 3 ft. apart. The iron casing is left on the columns as a finish and also a protection. This casing starts a little below the floor line and is carried up to the bottom of the brackets from the beams and girders. The concrete is deposited in small quantities from the top and well tamped into place with long handled rammers.

The various mixes of concrete were as follows: For column footings, fire walls, the upper part of beams and girders and floor slabs, 1 part cement, 2½ parts sand and 5 parts broken stone; for columns, 1 part cement, 1½ parts sand and 3 parts broken stone; for the lower part of beams and girders around the rods, 1 part cement, 2½ parts sand and 4 parts fine broken stone. For the granolithic finish on all floors the proportions were 1 part cement, 1 part sand and 1 part stone dust.

The floor was laid up in the following manner after the steel was in position: The lower

5 in. of beams and girder boxes were filled with a rather wet 1:2½:4 concrete, using broken stone which would pass a ¾-in. screen. The concrete was then brought up in the beams and girders to within about 1-in. of the finished floor line, this concrete being mixed in the following proportions, 1 part cement, 2½ parts sand and 5 parts coarse broken stone. The expanded metal which formed the slab reinforcement was then laid and the slab concreted to within 1 in. of the finished floor line. About 5 or 6 hours after the slab had been placed, the granolithic finish was put on. This granolithic finish was allowed to stand uncovered until it was sufficiently set and then covered with a roofing paper and kept well wet.

The set joints for the beams and girders were made directly at the center of the spans by a vertical board which fitted around the rods, and the joint in the slab was made on the same lines, finishing up against a vertical surface. The expanded metal was allowed to project a foot or so beyond the slab joint, and when the work was resumed, the next sheet of expanded metal was lapped on to that of the previous day's work some 6 or 8 in., thus forming a comparatively good tie through the joint.

There was a good deal of consideration given to the places where these set joints should occur, and, taking all things into consideration, it was deemed best to make the joints at the center of beams, girders and slabs, as this place was the point of zero shear and a practically faced joint could be obtained for all compression flanges, while the rods, being continuous, would take care of the tension entirely, as no tension was calculated as being taken by the concrete.

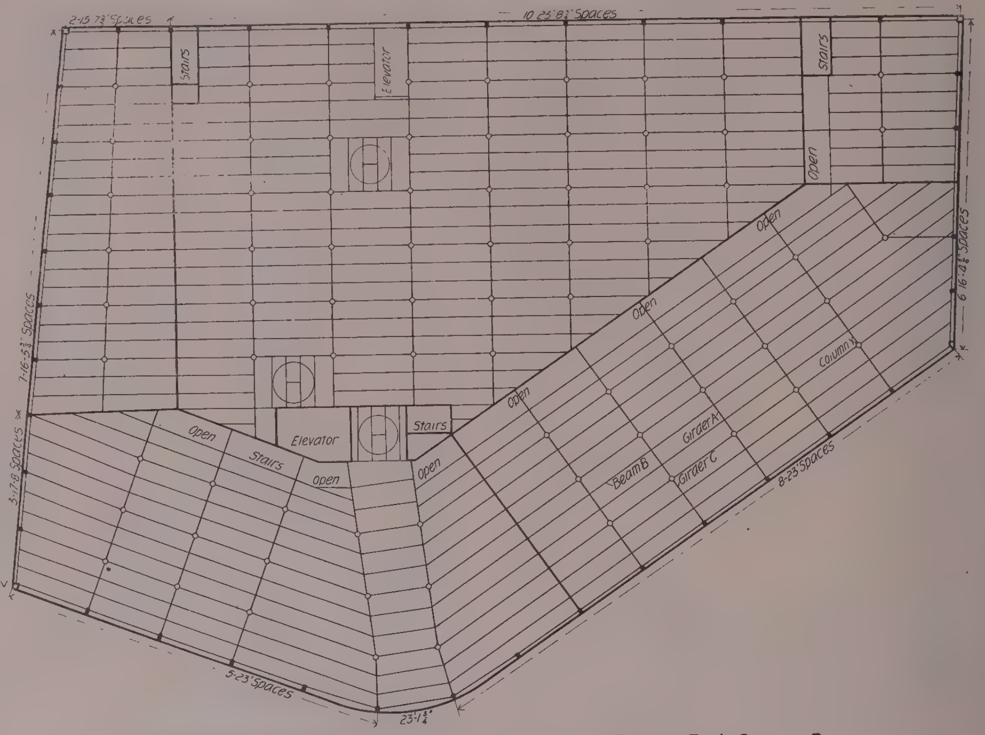
Owing to the height of the interior columns, there was some doubt as to the result from depositing the concrete from this height, so it was thought best to strip the galvanized iron casing in several instances to form some idea as to the quality of the concrete. The writer has seen one of these columns stripped and it proved to be very satisfactory.

The work of stripping the under side of the floor was begun about a week or ten days after the concrete was laid, and in general it has a very satisfactory appearance.

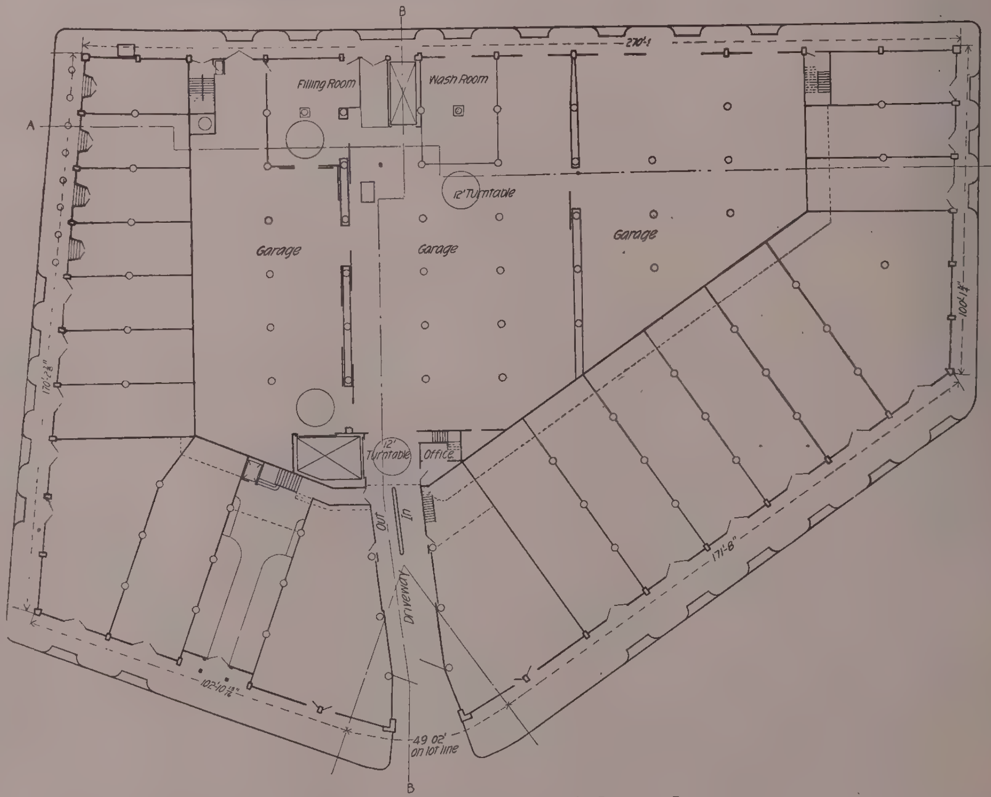
One of the other features of the building are the turntables which are provided for turning automobiles. These turntables were made very light and inexpensive and at the same time easy of operation. They were about 12 in. deep and 12 ft. in diameter, having a rim and center bearing. Special provision had to be made in the floor construction where they occurred.

It is estimated that there will be required for the superstructure about 7,500 bbl. of cement, 325 tons of steel, 2,000 cu. yd. of sand, 4,500 tons of crushed stone and 700 M. ft. of new lumber for forms. The cement used on this work is Lehigh, all of which is tested.

The contractors for the foundations were Gow & Palmer, Boston, this firm being the patentees of the type of footing used. Their contract amounted to $30,000. The contractor for the superstructure was the Eastern Expanded Metal Co., Boston, their contract being approximately $100,000. The architect was Mr. Edward T. Barker, Boston.



Plan Showing Arrangement of Columns, Girders and Beams, Park Square Garage.



Ground Floor Arrangements, Park Square Garage.

THE MUNICIPAL LIGHTING PLANT at Detroit is to be equipped with two 2,000-kw. Westinghouse-Parsons turbo-generators. The original plant had compound vertical engines of the marine type with rope drives to direct-current series generators. This system was gradually replaced with alternating-current apparatus direct-connected to vertical engines. The turbine units will be placed in the original building, replacing some of the rope-driven machinery.

The Tankage of Sewage.

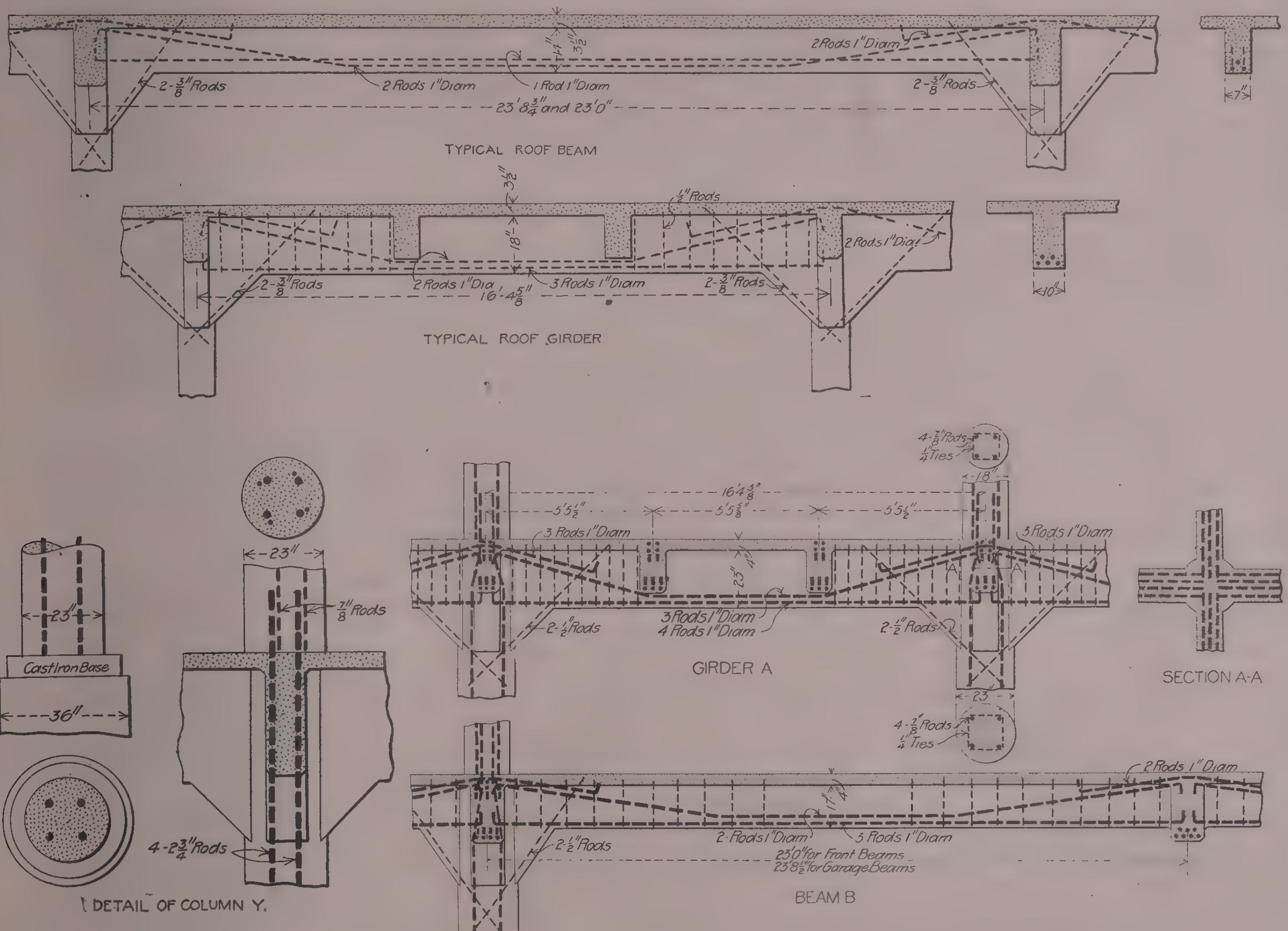
A paper read before the Royal Institute of Public Health by Mr. F. Wallis Stoddart.

The inspection, and comparison of a large number of sewage works, all based more or less completely on biological principles, has brought into prominence the fact that there is an imperfectly-understood difference in the final results obtained in different places under apparently identical conditions.

Putting aside, however, the comparatively limited number of examples in which the predominance of trade wastes or other local circumstances causes the sewage to depart appreciably from the normal, there remain abundant instances of works quite similar in construction and dealing with sewage of purely domestic type under apparently parallel conditions, where the general effect, including in this term both demand for supervision and perfection of final effluent, is by no means uniformly satisfactory, the chief cause of complaint being the production of offensive odors. On carefully tabulating these instances, and comparing them detail by detail, it becomes quite unmistakably evident that the most variable factor is the length of time occupied by the treatment and the degree of putridity attained by the sewage before arriving at the final stage of oxidation.

It is further noticeable that the acuteness of the trouble is in direct proportion to the completeness of putrefaction, and that in cases where the detention of the sewage is exceptionally prolonged there is a very abundant production of offensive gases, the effect of filtration is but slight, and the interior of the filter, of whatever type, when dismantled, is found to be occupied to a large extent by a black slime, which coats the particles of medium with a tenacious and offensive layer, or even fills up the interstices altogether.

The following are typical examples: (1) A well-managed precipitation tank followed by a continuous or intermittent filter, giving an inoffensive effluent, and the clinker remaining sweet and clean; (2) contact-beds; no nuisance arising when the duration of stay of the sewage was eight hours, but a serious nuisance arising when the sewage was held up for the greater part of the twenty-four hours; (3) a septic tank of capacity about equal to one day's flow; the general effect being that the tank effluent produced is distinctly more offensive than the ordinary sewage; the quantity of tank effluent capable of being treated per unit of filter capacity being less than with a good precipitation effluent, and slime being deposited in a filter following such a tank; (4) septic tanks of much greater capacity than one day's flow; he quoted an instance where, with a dry-weather flow of 3,000 gallons, storage capacity of about 14,000 gallons was demanded and provided, with the result that the whole contents of the tank were black as ink, the offence to the neighborhood was intolerable, and the filter was heavily loaded with black silt, which deposited in all the channels, and had to be removed where it could be reached.



Typical Beam, Girder and Column Details, Park Square Garage, Boston.

The septic tank is credited with the destruction of the separated solids by encouraging their digestion by bacteria, and with appropriate preparation of the liquid product for the process of oxidation, also by means of obscure changes brought about by micro-organisms. Both objects are effected by retardation of the rate of flow in order to afford time for the necessary changes to take place.

Tank Capacity.—Numerous examples show plainly that there is considerable uncertainty as to the best tank capacity; but it is probably correct to say that in general it is considered that the provision of 1 cubic foot for every 6¼ gallons of the dry weather discharge per day of twenty-four hours represents the most advantageous arrangement, affording storage to allow of the sufficient deposition and resolution of solids without demanding too great an expenditure; but it is also evident that there is a feeling in many quarters that any departure from this should be in the direction of greater capacity, and that where expense is no object the size of the tank may be advantageously increased. This tendency arises from the very general assumption, first, that certain ill-defined changes in the sewage as a whole are desirable, if not necessary, before oxidation; and secondly, that the longer the sewage is delayed in the tank the greater will be the destruction of deposited solids, and the smaller will be the amount of sludge to be ultimately disposed of. These assumptions are so plausible, and supported by so much authority, that their acceptance, shared until lately by the author, is hardly a matter of surprise.

The opinion that sewage as a whole requires septic treatment as a preliminary step to oxidation has been chiefly advanced by theoretical writers, and is apparently supported by the analogy of natural deposits of putrefactive matters. But a reference to the history of the modern sewage filter will show at once that the whole of the experimental work upon which it is based was carried out with perfectly fresh sewage.

The work of the First Royal Commission on Rivers' Pollution (1870), in the course of which the commissioners evolved the intermittent filter; that of the author (1884-1893), by which the possibility of continuous filtration was demonstrated; of Colonel Ducat (1898), and of the Massachusetts Board of Health and other investigators, was all carried out with fresh sewage.

It is evident, then, that so far as the production of a satisfactory final effluent is concerned, there is no need whatever to effect any preliminary change in the liquid portion—that is to say, in 999 parts out of every 1,000 of the sewage. Its detention possesses the disadvantage of producing bodies which are not only the cause of offensive odors, but also prejudice the action of the oxidizing portion of the plant to a very serious extent.

The assumption that the more complete the destruction of the sewage solids the smaller must be the amount of sludge to be ultimately dealt with, is wholly incorrect.

This became evident as soon as the progress of the experiments about to be described led to the subdivision of the tank.

This tank is divided into compartments by submerged walls, and is fitted with boards, one function of which is to direct the flow of sewage downwards, so as to ensure the absence of any direct current from inlet to outlet.

Now, if the sludge consisted only of the residue of original solids, it would naturally accumulate first in the compartment nearest the inlet, and progressively in the later compartments as the earlier ones became filled. But this is not the case when this tank is worked at the orthodox rate of 6¼ gallons per day per cubic foot. It is then found, after some weeks, when the septic action is well established, and the normal formation of scum has taken place, that there is as much or more deposit in the last compartment as in the intermediate ones, though these are not full. Further, the character of the deposit varies in the compartments, for whereas that at the inlet end of the tank is a pasty mass of sewage solids more or less broken down, that at the outlet end is a black unctuous silt, characterized by the presence of a large proportion of ferrous sulphide—in fact, the identical material already alluded to as collecting in that portion of the plant which follows the tank when the latter is underworked. It is a direct chemical precipitation brought about by interaction between the iron and other bases present in all sewages, and the soluble sulphides and carbonates produced in the course of putrefactive change. The constitution of this material is, of course, not constant, but the following analysis fairly represents its composition: Water, 77.30 per cent.; volatile and organic solids, 5.15 per cent.; fixed mineral solids, 17.55 per cent.

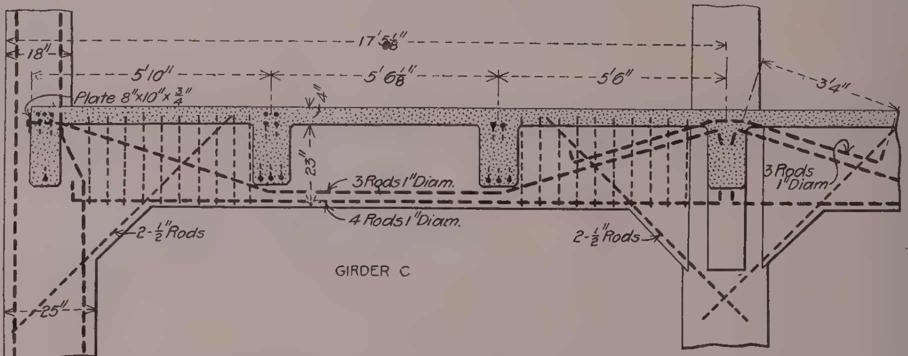
Of the solids, from 4 to 5 per cent. consists of ferrous sulphide, a substance which, when slowly precipitated, is associated with combined water, forming a bulky and tenacious gelatinous mass. Its other prominent features in the present connection are its black color, its avidity for oxygen, its resistance to bacterial disintegration, and its tendency to evolve sulphuretted hydrogen on exposure. On microscopical examination, no forms of life other than bacteria are observable. A marked difference between this deposit and ordinary sludge is seen in their respective resistance to bacterial attack. If a tank such as that described be sludged up at the usual rate of flow, and then allowed to rest, the deposit of sewage solids in the first compartments will practically disappear in about six months, while that in the last will be but little reduced, except as the effect of mere subsidence.

Secondary Deposits.—One more serious practical difficulty in sewage treatment directly traceable to the same cause—namely, over-putrefaction—is the formation of a thick blanket growth on the surface of the filter. This growth, which for want of a better explanation has often been stated to be connected with the mode of application of the liquid to the filter, is really due to the presence of sulphuretted hydrogen in the tank effluent. It consists of various species of sulphur bacteria which can only flourish in a situation where both sulphuretted hydrogen and air are present. The surface of a sewage filter fed with normal septic effluent, always charged with sulphides, is an ideal locality for these organisms, and they take advantage of it to an extent which may seriously interfere with the efficiency of the filter.

Precisely the serious phenomena described may often be observed where sewage is discharged into running water. Immediately adjacent to the outfall there is a deposit of sewage solids and a luxuriant growth of sewage fungus, but no marked discoloration or offensive odor. Further downstream, and often separated from the outfall by a perceptible interval, the black deposits and offensive odors, popularly attributed to the sewage itself, but really due to the products of its decomposition, are to be observed. It follows that under the usual conditions of work the destruction of original sewage solids in the septic tank is largely counterbalanced by new formations. If it were not for the constant discharge of appreciable quantities of this secondary deposit at the outlet of the tank, this phenomenon would have attracted greater attention, while the general absence of baffle walls has further disguised the local deposit by allowing the sludge to assume a fairly uniform level on the floor.

But the consequences of allowing these secondary bodies to form are still more disastrous. If any filter attached to a septic tank be dismantled it will be found that the pieces of medium are coated with a layer of black slime several millimetres in thickness, the surface under favorable circumstances being of a brown-red color, owing to the superficial oxidation of the ferrous sulphide, to which the black tint of the slime is due. Not only, therefore, is the aeration of the filter mechanically diminished, but the medium is coated with a material having an immense appetite for oxygen, and directly antagonistic to the function of the filter as an oxidizing agent.

A consideration of these facts naturally led up to a series of experiments, having for their object a determination of the conditions of working which allow of the most complete destruction of original sewage solids, with a minimum formation of the offensive and otherwise objectionable secondary products; or, reverting to the illustration of the polluted stream just given, to ascertain whether it would not be possible to adjust the plant so that the filter might be placed at the "perceptible interval," and so anticipate the development of offence by putting an end at once to the possibility of putrefaction in the sewage already denuded of its suspended solids. It was considered desirable at the same time to consider what modification of internal structure would best promote the retention of solids of all kinds at the inlet end of the tank, so as to prevent their escape on to the filter, and what is the best method of dealing with the residue. These various points were, of course, attacked more or less simultaneously, but it will add to the clearness of the following summary if they are now treated separately.



Detail of Girder from Wall to First Row of Columns, Park Square Garage.

The tanks employed were open to the air and measured 19 ft. 2 in. by 6 ft. 11 in. by 6 ft. deep, having a net capacity of 4,910 gal.

The arrangement of subdividing the tank by submerged walls and scum boards was retained, but the dimensions of the partitions of both kinds underwent considerable change in the course of the experiments.

The following arrangement was found to give the most useful results: Each tank is divided into four compartments by three dwarf walls placed at equal distances apart. The first wall is brought up to an inch from the surface, and the first compartment therefore forms a sumph, which can be dealt with in any desired way without disturbing the rest of the tank. The remaining walls rise to 1 ft. from the surface. All the scum boards, except that connected with the outlet of the tank, dip 2 ft. into the liquid, and therefore overlap the walls by 1 ft. They are placed vertically midway between the walls. The withdrawal of the tank effluent is by means of a plain sill, protected by an obliquely placed scum board. The whole arrangement has been given an extended trial, and the tanks so equipped have worked more uniformly and successfully than any other modification.

Rate of Flow Through Tank.—If the sewage were delivered at a uniform rate throughout the twenty-four hours it would be a comparatively easy matter to determine the definite rate at which the best results were obtained, and to fix the tank capacity in accordance therewith. In actual practice it is necessary to make a considerable allowance for natural variations, due partly to variable rate of production, partly to increase by storm water, some at least of which it is generally agreed should be submitted to tank treatment; and there seems to be no good reason for departure from the practice, based on the regulations of the local government board, of fixing the limit quantity to be so treated at three times the normal dry weather flow.

It appeared, then, that the most direct way to attack this part of the problem would be to carry out two series of experiments—a preliminary series, in each of which a constant flow of full strength dryweather sewage would be maintained for a prolonged period, and a second series, in which the maximum rate so determined as satisfactory would be adopted as the maximum threefold flow, but in which the actual rate of flow would follow the natural variations, the tank capacity being so adjusted that the average dry weather flow would be one-third this maximum.

These experiments, like those which led to the elaboration of the continuous sewage filter, were carried out with that treated at the Horfield works at Bristol. The quantity of dry weather sewage averages almost exactly 15 gal. per head of population; and partly in consequence of this low figure, partly because a large proportion is derived from the Horfield barracks, the strength in organic constituents is, as has been attested by numerous independent observers, very much above—more than twice—that of average domestic sewage.

It was established in the experiments on filtration that the proper maximum rate of application to the continuous filter of the Horfield dry weather sewage after tanking is 300 gal. per cubic yard per twenty-four hours; if the experimental tanks produced a liquid capable of yielding a filtrate of equal merit at the same rate, and possessing the necesary physical recommendations, they were held to be working satisfactorily.

Reverting to the first series of experiments, that in which the tanks were fed a constant rate over prolonged periods with dry weather sewage, it was found that excellent results were obtained up to a rate of flow corresponding to three tank capacities a day, or to 20 gal. per day per cubic foot of tank capacity. At 30 to 35 gal. per cubic foot (five to six capacities) the filtrate began to deteriorate, as shown by the appearance in the filtrate of the persistent opalescent characteristic of sewage and tank effluent, while at 56 gal. (nine capacities) the filtrate was hardly distinguishable in appearance from tank effluent, although there was still a fairly strong nitrification. This opalescence is perhaps the most valuable of the rapid tests for final effluent, as its appearance invariably indicates the approaching breakdown of the filter. The rate of flow on the filter being, of course, maintained at the same rate throughout, the appearance of the filtrate was plainly due to the excess of finely divided solids, amounting at this time to 43.5 parts per 100,000, brought forward by the rapid flow through the tank.

At this point an interesting observation was made as to whether the continuous filter would deal with this inferior tank effluent at a reduced rate.

On cutting the flow down to 110 gal. per cubic yard, nitrification advanced quite normally, the nitric nitrogen in one experiment reaching 6.6 parts per 100,000; but the appearance of the filtrate was practically unchanged, and as the opalescence undoubtedly implies the presence of much organic oxidizable matter, the value of high nitrate was heavily discounted, and it was therefore decided that extension of filter area would not compensate for insufficient tank accommodation.

At all rates of flow, from 12 gallons per cubic foot upwards, the tank effluent was inoffensive. There was a complete absence of the bacterial scum, the formation of which is a source of so much trouble to both tank and filter.

It was concluded from the first series of experiments that the best constant rate of flow—that is to say, the most rapid uniform rate at which full-strength sewage could be passed through the tank with most satisfactory results as regards both destruction of sewage solids and quality of tank effluent—is insured by providing a tank capacity equal to one-third the day's supply of sewage, or 1 cubic foot for 20 gallons, and that the extreme limits between which satisfactory results can be obtained are 12 and 35 gallons per cubic foot respectively.

The most promising conditions for the second series of experiments were thus made extremely clear. For if it is desired to treat in the tank quantities of sewage up to three times the average dry-weather flow, and the maximum amount the tank is capable of treating is 35 gallons per cubic foot (six capacities), it is evident that the dimensions of the tank should be such as to provide 1 cubic foot for each 12 gallons of dry-weather sewage (two capacities), or, in other words, that the tank should be capable of holding half the average dry-weather daily flow. In this way the normal increase of about 50 per cent. which occurs during the busy hours of the day will bring the rate of flow to the most favorable state—namely, 20 gallons per cube foot; and in times of rain the tank will still be able to deal with an additional 15 or 20 gallons per foot, which will only bring the rate to the maximum the tank will deal with on the assumption the sewage is of full strength and not diluted. The chief danger appears to lie in the possibility of too much stagnation during the night, when, of course, the rate is much diminished.

Accordingly, the capacity of the tank being practically 5,000 gallons, arrangements were made by which a portion of the crude sewage, corresponding in all respects as regards composition and rate of flow to the main supply, and varying in amount from 10,000 gallons per day in dry weather to 30,000 gallons when sufficient was entering the works, was admitted.

This experiment was started on November 18, 1904, and has continued without cessation. The effect has been exactly what was desired. The tank effluent has always been inoffensive and sufficiently free from suspended soils; and these last consist of light brown, flocculent matter, entirely devoid of the black, slimy silt characteristic of the septic tank effluent. On the near side of the first scum-board a thick floating mass of paper, matchsticks, and the like forms, but there is little or no true bacterial scum even there, while the latter parts of the tanks are destitute of scum of any kind. The only particular in which the results have differed from those obtained when the tank was worked under uniform flow, is that at the maximum rate of 35 to 40 gallons per cube foot when maintained for days at a time by heavy rainfall, as in the first two weeks of March, a much better tank effluent was obtained than with full strength sewage, and it was evident that this upper limit might be extended for dilute sewage if desired.

The suspended solids in the tank effluent have varied from 8 to 20 parts per 100,000, but are fairly uniform, at about 14 parts. Hourly samples collected throughout June 29th, when the conditions had been normal for some time, and mixed in the proportion of the flow, gave 96 parts in the sewage, 14 in the new tank and 16 in the precipitation tank.

Each month the first compartment has been filled to an average depth of 3 ft. 6 in., and therefore contained 125 cubic feet. The composition of the sludge on the average is as follows: Water, 91.72 per cent.; volatile and organic, 4.48 per cent.; mineral, 3.80 per cent. The month's accumulation of dry solid matter from 300,000 gallons of sewage amounts therefore to about 6 cwt.

There is a good deal of difference of opinion expressed as to the amount of sewage solids actually destroyed in the septic tank, but it probably seldom, if ever, exceeds 50 per cent. of those introduced with the sewage, and is generally put at from 30 to 40 per cent.

In the present instance, making a liberal allowance for solids carried over with the tank effluent, the proportion which disappears must exceed 50 per cent. The modifications in the construction and use of the tank now suggested succeed, therefore, in abolishing the most serious drawbacks of the septic tank without relinquishing any of its advantages in respect of the easy and economical destruction of solids. But in order to secure these advantages it is plainly necessary to acquire a fairly accurate knowledge of the average amount of sewage to be dealt with, and nothing is more astonishing in connection with schemes of sewage disposal than the general absence of information as to the volume of sewage dealt with, even in existing works.

Sludge Disposal.—As has already been stated, the accumulation of sludge, even at the more rapid rates of flow, was surprisingly slow, showing that the resolution of sewage solids proceeds much faster than has hitherto been suspected, and is quite independent of the formation of a thick bacterial scum and the other unpleasant evidences of over-putrefaction.

The sludge formed under the conditions laid down is less stable than that formed under prolonged bacterial action, and, further, is not mixed with the secondary deposits, which are little, if at all, amenable to this action. Such a deposit, then, if left to itself, will very materially diminish, and a very considerable destruction of solids can be effected in this way without expense or offence.

But an obvious objection to allowing the tank to sludge up is that it alters the capacity of the tank.

The best way to remove the sludge from tanks of the type described is to lift it out by means of a chain-pump. Sludge channels into outside sumps are not satisfactory, because the sludge becomes compacted, and the supernatant water bores through it and escapes.

The intervals that may elapse between successive removals of sludge will vary with the character of the sewage, but this is not likely to be necessary at shorter intervals than at Horfield, where the removal takes place once a month.

To dispose of the sludge a plot of ground 32 ft. square has been trenched, and suffices for three applications; the sludge, however, drains rapidly, and leaves such a small actual residue that the same trenches could be used more frequently. The sludge produced is quite inoffensive, and yet is naturally of high manurial value, containing, when air-dried, about 2 per cent. of nitrogen and phosphoric acid, equivalent to 1 per cent. of tricalcic phosphate.

As already stated, the bank which forms the subject of this paper commenced work on November 18, 1904. A few inches of sludge soon appeared in the second compartment, being carried over from the first at times of heavy flow, but the third and fourth remain entirely free from sludge.

The Abandonment of the Harvard-M. I. T. Merger.

The proposed alliance of Harvard University and the Massachusetts Institute of Technology has been given up, for a reason fully stated in the following letter from President Pritchett of the Institute to President Eliot of the University: "I am directed by the Corporation of the Institute of Technology to communicate to you the fact that, in view of the recent decision of the Supreme Court of the State in the case of John Wilson et al. *vs.* The Massachusetts Institute of Technology, the Corporation of the Institute finds it impossible to proceed with the plan of co-operation which was considered at its meeting of June 9. In communicating this fact the Corporation desires a the same time to express its appreciation of the fairness and courtesy of the Corporation of Harvard University in our common effort to solve a difficult question." This letter was read at a meeting of the fellows of the University, and it was voted that the committee of conference appointed by the Harvard board on May 16, 1904, at the instance of the Corporation of the Massachusetts Institute of Technology, be discharged, and that the president be requested to express to the members of the two committees of conference the high appreciation by the president and fellows of the foresight, good judgment and public spirit of which the committees' project for a close affiliation between the Institute and the University gives evidence, and the regret of the president and fellows that the project has been brought to naught by the recent decision of the supreme court, which makes it impossible for the Institute to place itself beside the University.

This result will be welcome to a very large majority of the Institute's alumni, and there are some grounds for believing that many influential Harvard alumni are not displeased at the court's decision. Just what will happen to the Lawrence Scientific School has not been announced, if, indeed, it has been decided. The hope has been expressed by a large number of eminent engineers that the great financial resources for technical education which Harvard now has will be used in developing an institution for engineering research rather than making the Lawrence School a great rival of the Massachusetts Institute in strictly undergraduate instruction. There is no demand for a second polytechnic school so near Boston, but the importance of the engineering profession and its constant appeal for more accurate scientific methods and data render a technical college for post-graduate studies and experiments one of the greatest needs of education. Such a college will be very expensive to equip and maintain, but the resources of Harvard bequeathed for the purpose of technical education places the University in a peculiarly favorable condition to carry on such work.

The Thirty-Ninth St. Sewage Pumping Station, Chicago.

Although the opening of the drainage canal at Chicago greatly improved the sanitary condition of the Chicago River, a large amount of intercepting sewer construction and reconsruction of the existing sewerage system had to be undertaken, and two pumping stations built before the sewage of the city could be diverted entirely from Lake Michigan. This work was commenced in 1898, and is now nearing completion. The plans for the improvements were outlined and a portion of the construction work described in The Engineering Record April 9, 1898, and August 12, 1899. The general scheme of the plans proposed at that time has been followed in the work that has been carried out, but certain features of them have been completely changed.

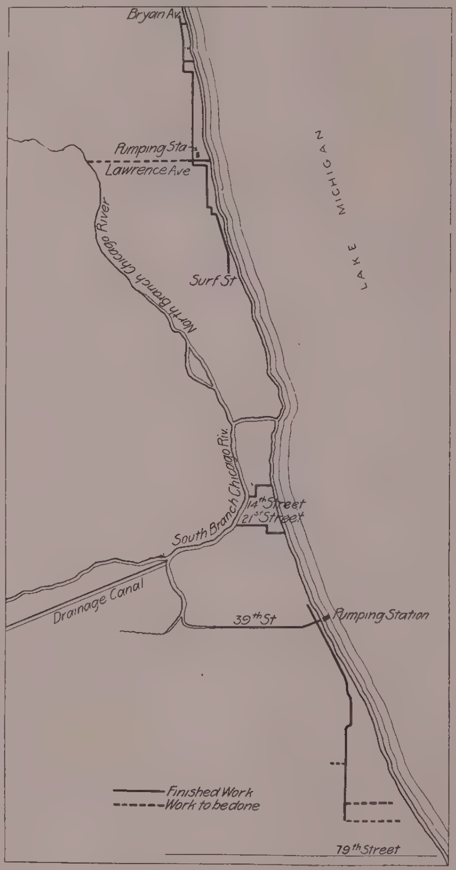
Prior to 1889 there were only three sewers of the entire sewerage system discharging into the lake, the remainder having their outlets in the Chicago River. Since then, however, the city has extended very rapidly along the lake shore to the north and south and away from the river. A large number of outfalls, extending into the lake, were built for the sewers of this new territory. In order to divert the flow from these outfalls to the river, and thence to the drainage canal, a 16-ft. intercepting sewer, 4.5 miles long, which reduces to 12.5 ft. in diameter toward the end, had to be built along the lake on the south side of the city; and two sewers, one 6 ft. and one 8 ft. in diameter and both decreasing in size toward the limits of their drainage areas, with a total length of 6 miles, had to be built parallel to the lake on the north side. A large crosstown conduit connects each of these main interceptors with a branch of the river. Two smaller crosstown interceptors were also built on the south side, one at 14th St. and the other at 21st St., changing the discharge of the sewers north of 31st St. from the lake to the main branch of the river.

The crosstown conduit on the south side is built in 39th St., and the one on the north side in Lawrence Ave., both connecting the lake with the river in order to obtain the required amount of pure water from the former to fulfill the object of the drainage canal. The crosstown connecting conduits have been made large enough to supply the necessary water from the lake and at the same time provide outlets for the intercepting sewers. The elevation of the invert of each main interceptor at its junction with its conduit is such that pumping stations had to be built to elevate the sewage at these points, and also to pump lake water into the conduits. The south side station is at the edge of the lake at the foot of 39th St.; the north side one will be erected at Lawrence and Evanston Aves., about ½ mile inland from the lake.

An outline map showing the river, the drainage canal, the intercepting sewers and the location of the two pumping stations is given in an accompanying illustration. The amount of work finished and the work yet to be completed is also shown on that map. The two small interceptors, the connecting conduit and the large interceptor, with the exception of the reversal of two large connecting trunk sewers, have been finished and in service for some time on the south side. The 39th St. pumping station is nearly completed and will be partly in operation in the immediate future. The main interceptor on the north side has also been finished. The Lawrence Ave. pumping station and the conduit connecting it with the north branch of the river have just been put under construction, with the stipulation that they be completed by July 31, 1906.

The 39th St. pumping station will have a rated normal capacity of 900,000 gal. a minute, made up by two screw and four centrifugal pumps. The intercepting sewer at this station is built in a narrow strip of land between the eight tracks of the Illinois Central R. R. and the lake, so the station had to be built entirely outside the bulkhead line and in water from 8 to 12 ft. deep. The station building has a brown pressed-brick exterior, trimmed with Deer Island granite, and a steel framed truss roof. It contains a main machinery room, 125x134 ft. in the clear in plan, with a gate house, offices and convenience room on the lake side of this machinery room, a 48x50-ft. boiler room at one end, and a 37x48-ft. fuel receiving room joining the boiler room. The building stands on a monolithic concrete footing, large concrete piers being carried down from the bottom of the footing of the main portion to a thick layer of hardpan at a depth of 34 ft. below mean lake level, the latter being taken as datum.

The screw and four centrifugal pumps with their engines are all in the main machinery room, located as shown in one of the accompanying illustrations. The screw pumps are, of course, submerged and the centrifugal pumps will also operate submerged. The waterways leading to and from the pumps are monolithic concrete of massive proportions, built on heavy concrete piers extending down to hardpan. The centrifugal pumping units are arranged in a row along one end of the machinery room. They are of the vertical type with suctions from below. Two of them are designed for a capacity of 75 cu. ft. a second each, and are intended to pump the dry-weather flow from the intercepting sewer into a gravity channel leading transversely the width of the building near its center line from an intake in the lake to a connection with the crosstown conduit. These pumps will also be used in conjunction with the other two centrifugal units to discharge the combined dry-weather and storm-water flow of the interceptor into the gravity channel. The capacity of the two larger centrifugal units is 250 cu. ft. per second. Each pump is directly connected by a vertical shaft to a horizontal triple-expansion condensing engine on the floor of the machinery room. The engine beds and pump pits are monolithic concrete built up from the hardpan, the engine beds having a total height of about 45 ft.



Intercepting Sewer System, Chicago.

The connection with the intercepting sewer is made at the south corner of the building on the shore side, the invert of the connection being 20 ft. below datum. A 27x28-ft. screen chamber is built in this connection just outside the line of the building. Beyond this a channel, 12 ft. wide with its bottom from 21 to 23 ft. below datum, or 30 to 32 ft. below the floor of the machinery room, leads along the end of the building for 130 ft. to the corner on the lake side, where it turns 90 deg. and continues until it joins the gravity channel near the outer end of the latter. A sewage well, with its bottom 23 ft. below datum, is formed in the inlet channel beyond the screen chamber by a concrete wall, 8 ft. high, built across the channel. A heavy, vertical, automatic swing-gate, 11 ft. 6 in. wide and 20 ft. long is hung from its top end transversely across the channel at this wall so that it seats against a brass seat on the gate frame. This gate and the cross-wall thus seal the sewage well from the remainder of the inlet channel.

The gate swings open away from the sewage well and is designed to operate automatically during a storm and admit the storm-water flow to the pumps provided to handle it. The two smaller centrifugal units are at the shore end of the row of four, and will handle the dry-weather flow. Their pumps are in circular pits, with bottoms 19.5 ft. below datum and 30.5 ft. below the machinery floor level, the center line of the discharges of the pumps being 17 ft. below datum. The suction connection between each pump and the sewage well is built in concrete and has a 4x6 ft. elliptical section at the well, which changes to a 4-ft. circular section as it approaches the bottom of the pump pit. The minimum quantity of sewage from the interceptor at the present will be 25 cu. ft. per second, and with this quantity flowing the level of the water in the sewage well will be 17 ft. below datum. With the maximum estimated dry-weather flow of 148 cu. ft. per second the level of the water in the sewage well will be 15 ft. below datum. The two smaller pumping units are required to work within this range in quantity and head, which will occur under normal conditions during dry weather.

The combined flow of sewage and storm water may reach 666 cu. ft. per second, and when the flow exceeds the capacity of the two small pumps one or both of the larger pumps will be operated as required. The normal service of the larger units is thus to occasionally elevate and discharge the combined sewage and storm-water flow, but they may also be utilized to pump lake water into the gravity channel. When the larger pumps are handling a flow from the interceptor a lift gate is closed at the end of the inlet channel where it joins the gravity channel, thus forming a main pump well of the inlet channel extending from this gate back to the interceptor and including the sewage well. The bottom of each of the pits in which the two larger pumps are placed is 9.5 ft. below datum. The suction connection of each of these pumps with the main pump well is similar to the connection between the smaller pumps and the sewage well, and is 7x11 ft. in cross-section at the well end and 7 ft. in diameter at the pump pit.

To prevent backwater in the sewer draining to this pumping station it is necessary that the water surface in the main well shall be kept at least 6 ft. below datum in time of excessive rainfall. With a lesser rainfall, to obtain the best practicable velocity in the main sewer, the water surface must be kept at a lower level depending on the quantity of combined sewage and storm water flowing to that well. The water surface in it will consequently vary from 6 to 14 ft. below datum. The greater part of the service to be performed by the larger pumps will occur, however, with that surface 11 to 13 ft. below datum, the quantities for these pumps ranging from 100 to 250 cu. ft. per second. The swinging gate remains closed when the lift gate controlling the connection between the inlet and gravity channels is open and seals the sewage well from the remainder of the inlet channel. When this lift gate is closed and the larger pumps have lowered the water level in the main well between that gate and the swinging gate below the level of the water in the sewage well, if the latter level is above the top of the dividing wall, the swinging gate opens and the larger pumps begin to draw from the flow of the interceptor.

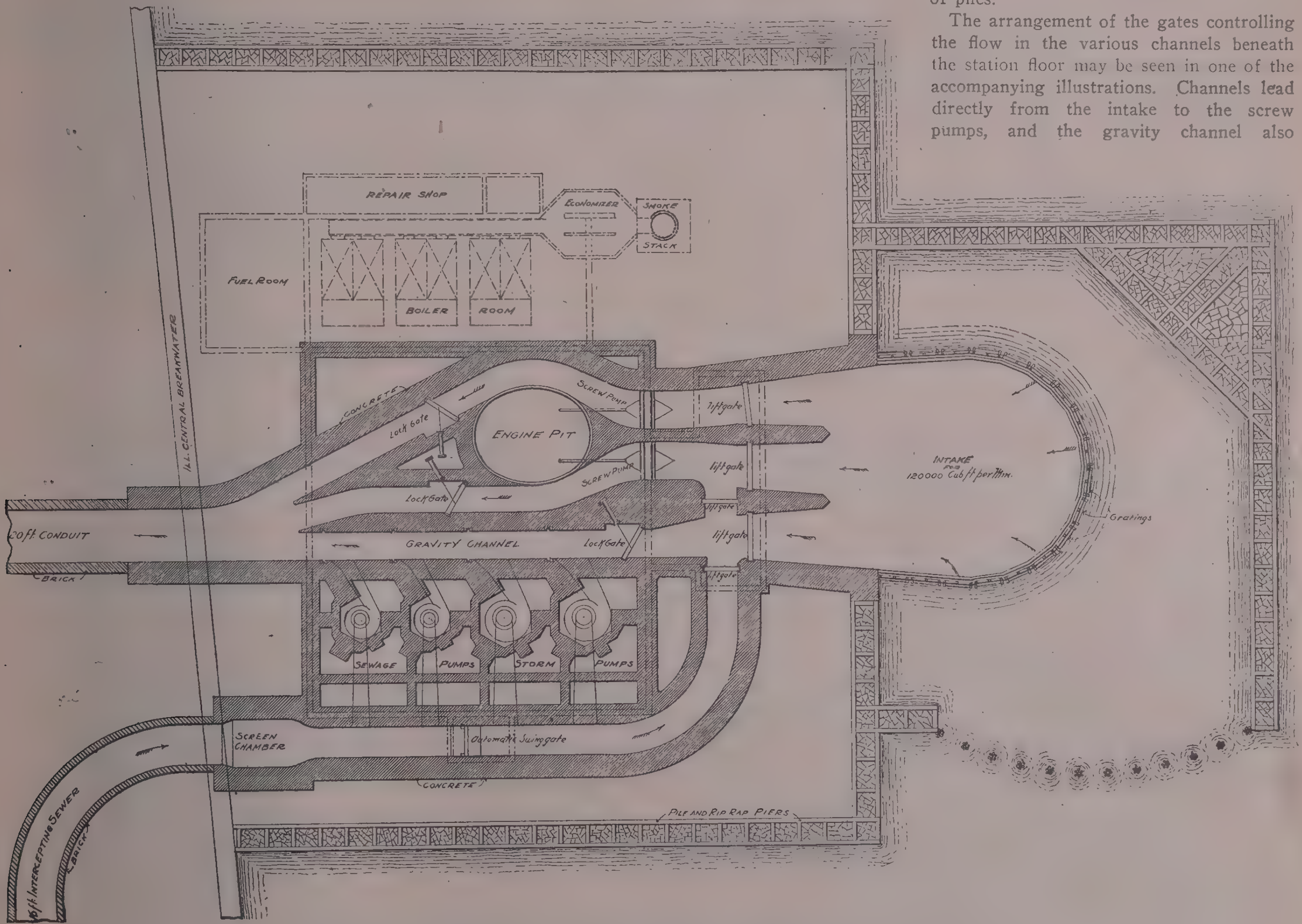
The pumping plant was built to furnish at least 2,000 cu. ft. of lake water per second through the crosstown conduit and thence through one fork of the south branch of the Chicago River to the drainage canal, in addition to pumping sewage from the interceptor into that conduit. Under certain conditions, which may be considered normal since the opening of the drainage canal, the level of the lake is about 1½ ft. higher than the level of the river at the end of the conduit. The latter has a 20-ft. circular section at the pumping station and is laid so a gravity flow from the lake to the river takes place through it. The flow is not always equal to the required amount, however, and the deficiency will be supplied by either or both of the screw pumps. These pumps are in concrete channels beneath the corner of the building diagonally opposite from the connection between the interceptor and the inlet channel pump well. Their engines and water channels are on the opposite side of the transverse gravity channel from those of the centrifugal pumps.

The arrangement of the screw-pump water channels and the method of operating those pumps may be best explained by reference to the accompanying illustration showing all the waterways of the station. Each pump is placed in a horizontal cylinder, 14½ ft. in diameter and 16 ft. long, built up in concrete, the inverts of the cylinders being 21 ft. below datum, or mean lake level. The cylinders are flared out at both ends by raising their arches, while the cross-section of the channels leading to the pumps from the intake and away from them to the conduit become oval in cross-section as they approach their connection with the cylinders.

Each screw pump has a capacity of 666 cu. ft. per second, and is direct-connected by a horizontal shaft to one of two vertical triple-expansion marine engines in an engine pit built between the waterways leading from the pumps to the conduit. The engine pit is oval, 37x45 ft. in plan, and 26 ft. deep, with its floor 16 ft. below datum. It is built on 16 ft. of concrete founded on the hardpan, and is floored and lined to the top with heavy cast-iron sections, the pit containing 320 tons of lining. Each screw-pump unit is independent of the other, their waterways being separate and passing on opposite sides of the engine pit. The arrangement and operation of the engines and pumps are similar to the arrangement and operation of a twin-screw ship, except that in this case the water moves forward past the engines and the engines and screws do not change position. The head the screw pumps will be required to operate against is about 7 ft. During the winter, however, it is possible and is intended to use the gravity channel only to supply lake water.

The lake water comes to the pumps and to the gravity channel from the lake through a horseshoe-shaped intake built out from that side of the station building. The intake is 80 ft. wide at its junction with the gate house and 80 ft. long from its outer end to its inner edge. It has a level concrete floor at 20 ft. below datum, which is supported on piers built up from the hardpan. The flat top which covers it is 4 ft. above datum and consists of a 4-in. plank floor, laid with open joints and supported on a grillage of I-beams carried by cast-iron columns. The columns are on bearing plates imbedded in the concrete of the floor, and are incased in wooden boxes. The water enters through eighteen vertical wooden-slat screens, 11 ft. 3 in. wide by 14 ft. high, spaced about equally in the sides of the intake. In order to avoid as far as possible any difficulty from the heavy ice gorges which occur along the shore the pumping station and intake are surrounded by a protection pier and breakwater. The heaviest jams of ice come from the north, so the water is drawn through an opening in the south side of the breakwater, which is protected by clusters of piles.

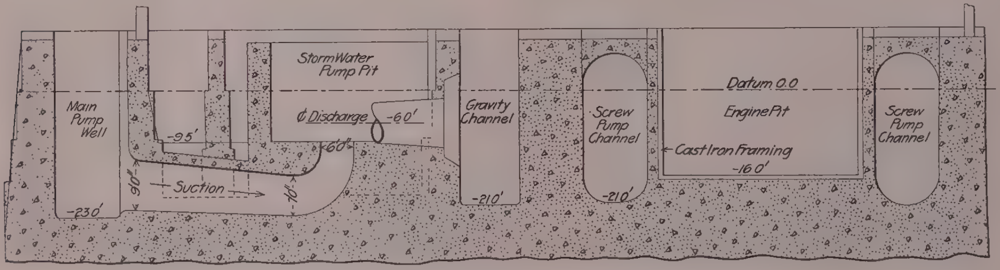
The arrangement of the gates controlling the flow in the various channels beneath the station floor may be seen in one of the accompanying illustrations. Channels lead directly from the intake to the screw pumps, and the gravity channel also extends out parallel with the former to connect with the intake. The gravity channel and the channel leading to the south screw pump are connected on the lake side of that pump. This connection and the three channels leading in from the intake are each controlled by a lift gate, all of which are operated in the gate house. The gravity channel and each of the channels leading from the screw pumps to the crosstown conduit are also fitted with a heavy lock gate, which swings horizontally on a vertical hinge in the concrete side wall and is operated hydraulically. The walls of the gravity channel contain, in addition, four pairs of vertical guides for timber walls which are arranged so the water may be pumped out of the chamber thus formed in that channel in front of any one of the centrifugal units, without interfering with the operation of the other pumps.



Plan of the 39th Street Pumping Station, Showing Arrangement of Pumps and Channels.

The operation of the centrifugal units independent of the screw pumps has already been explained. Should it become necessary to cut one of the former out of service, as just mentioned, the discharge of the remainder of those units in service toward the lake from the idle one may be sent to the conduit through the south screw pump. The channel leading from each screw pump to the conduit is designed for a slight static head, while a free flow will occur in all the other channels and they are only floored over at the level of the machinery room. The cross-section of the screw-pump channels changes from an oval to a rectangular shape and increases considerably in size just beyond the engine pit. This increase is made by raising the tops of the channels, their inverts remaining at the same elevation, 21 ft. below datum, until the conduit is approached, where they rise to 20 ft. below that level. The under side of the flat tops in the rectangular section, which continues for about 67 ft., is 8.5 ft. above datum. The cross-section changes to a circular one again at the end of the rectangular section, as the gravity and two screw-pump channels approach the conduit, the top of the latter channels being brought down to datum again. A chamber is thus formed above the water level in these channels which is more or less filled when the screw pumps are in operation and a flow induced through the conduit depending in amount on the height of water in those chambers.

Steam will be furnished for the operation of the plant by six 264-h. p. Cahall water-tube boilers in the boiler room. These boilers, the feed-water heaters, and all other auxiliary equipment in the boiler room were made and installed by the Aultman & Taylor Machinery Co., now consolidated with the Stirling Co., of New York. The boiler plant is served by a radial brick stack, 188 ft. high above the footing, built by the Alphons Custodis Chimney Construction Co. The stack rests on a concrete footing, 30x32 ft. in plan and 15 ft. deep, which is built on a timber grillage over 100 piles driven to hardpan. The base of the stack is cut granite and brown brick to a height of 36 ft.; above that the outside is a buff radial brick with ornamental iron collar trimmings toward the top.



A Cross-Section Beneath the Station Building Floor.

The construction of the pumping station outside the bulkhead line of the lake was attended with considerable delay, owing to the constant northeast winds during 1902 and 1903. A permanent protection pier was built and the area of the building dredged out to a depth of about 22 ft. below datum. This pier is a rock-filled pile structure, made up of two rows of piles 10 ft. apart, with wales and ties and with a line of Wakefield sheeting between the rows of piles, the top of the structure being 8 ft. above datum. The outside pier, or sea front is made 20 ft. wide with three rows of piles, the additional row being down the center. The corner on the north end of this outer pier is fully exposed to the force of the ice under the drive of the northeast wind, and is heavily braced in the rear. On this face the only serious leak in the coffer-dam occurred, resulting from a storm. The extreme dimensions of the coffer dam are 190x520 ft. It is built mostly in connection with the protection pier, partly inside and partly outside, and shaped to follow the line of deep foundations.

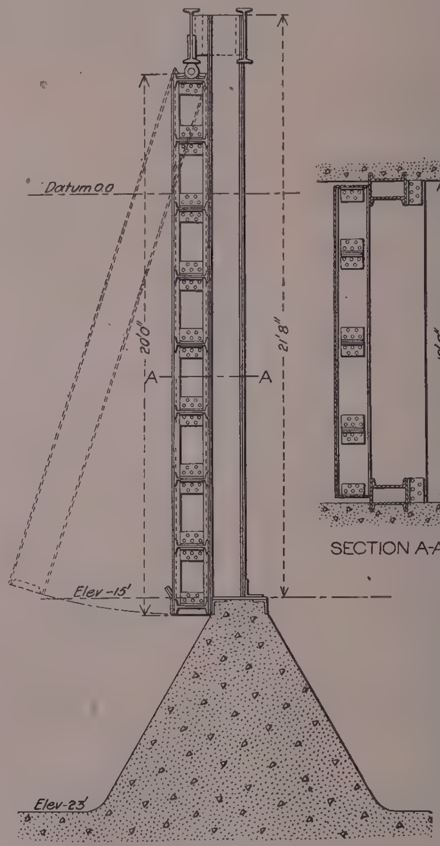
The original plans, made on the indication of borings, provided all walls and engine foundations to be carried on piles. After the space was enclosed by the protection pier a test pit was sunk which showed dry hard pan 7 ft. below the proposed bottom of the deeper concrete walls and piers. The piling was, therefore, abandoned and the walls of the water channels carried on 5 x 11-ft. transverse piers, footed on the hardpan. The engine settings were also carried down to the same foundation.

Where the cofferdam is built in connection with the pier, the latter is sheeted on the lake side of the inner row of piles with a row of 6 x 12-in. Wakefield piling driven to hardpan. This forms one wall of the cofferdam. The other wall is made up of a row of 9 x 12-in. Wakefield piling driven to hardpan and bolted to 4 x 12-in. waling pieces on a row of heavy piles. This wall is also tied to the protection pier by heavy iron rods. The space between the two cofferdam walls has a minimum width of 16 ft., which is increased to more than 80 ft. along the north side. Some of the material dredged from the site, and from other places where good puddling material could be obtained, was used in filling the cofferdam, the top of which is 3 to 4 ft. above the water level.

The cofferdam is braced on the inside by two tiers of heavy transverse and longitudinal timbers, extending over the entire area covered by it. The timbers are carried by longitudinal rows of piles, the rows being 32 ft. on centers and the piles in them 16 ft. apart. The piles are 40 ft. long and extend 22 to 26 ft. above the excavated bottom. The upper horizontal tier of timbers is at the tops of the piles and the other 8 ft. below it. The size and spacing of the timbers in both tiers are the same. The longitudinal braces between the piles of a row are 12 x 12-in. timbers, reinforced on both sides by a 2 x 12-in. plank, making 12 x 16-in. longitudinal braces on 32-ft. centers, transversely. The transverse braces are 12x12-in. timbers, 32 ft. long, extending from row to row of the piles. Midway between the main longitudinal braces are rows of 6x12-in. longitudinal timbers with vertical supports between the tiers dividing the bracing into panels 16 ft. square.

The piles for the bracing were driven by a floating pile-driver boat as the dredging progressed. The timbers for the top tier of braces were floated into place and spiked in position with the water at its normal level, which is about half way up on the sides of those timbers. When the top tier was in position the water was lowered to the level of the bottom tier and the timbers for the latter floated into position and fastened as in the upper tier. The main timbers in all cases were notched into the piles 2 in. to hold them more rigidly in place. The remaining water was afterward pumped out and the construction work carried on completely in the dry. The cofferdam as built was watertight, but considerable difficulty was experienced from waves breaking over the north and east sides of the pier. A vertical row of 6x12-in. timbers, 6 to 10 ft. high, was built on top the pier, making it 14 to 18 ft. above mean lake level. Even then the waves broke over it in great volume during rough weather, requiring the pumps to be operated. The varying weather conditions also interfered with the construction of the pier and cofferdam to no small extent. The level of the lake varies with differences in barometric pressures, changes of a foot or more in its elevation taking place in a few minutes under certain conditions in the summer. A wind prevailing in one direction will affect the lake level likewise, although not so suddenly. There is, moreover, frequently a very heavy ground swell in the lake off the Chicago shore, even when the surface appears calm, which makes the handling of a pile-driver boat very difficult.

The footings for the intake and building and the machinery settings required about 30,000 cu. yd. concrete, which was mixed in the uniform proportions of 1 of Atlas Portland cement, 3 of sand and 6 of broken Joliet limestone. The exposed surfaces of all water channels are faced with 4 in. of 1:3 mortar below datum, and with 2 in. of 1:3 mortar above that level. The concrete was mixed in a Drake mixer, adapted to mix the mortar before it was added to the stone, set on the north side of the station site. A spur track was run in from the Illinois Central R. R. on a pile trestle along the north side of the site, the base of rail being about 15 ft. above the upper tier of cofferdam braces. The concrete mixing plant was set up on the south side of this track. A delivery platform was erected about 8 ft. below the track and the mixer set on another platform below it at the level of the top tier of braces. The concrete materials could thus be passed from the cars to the mixer by gravity.



Automatic Swing Gate in Pump Well.

This position of the mixing plant was maintained throughout the work. The concrete was delivered largely from the mixer to various parts of the work in buckets handled by four guyed derricks, operated by Lidgerwood hoisting engines. The derricks had 60-ft. booms and a capacity of 5 tons each. One of them was set near each corner of the building so they commanded its entire site. The concrete in the floor and footings for the intake was transported from the mixer to position in small dump cars on a narrow-gauge track laid on the bottom of the excavation.

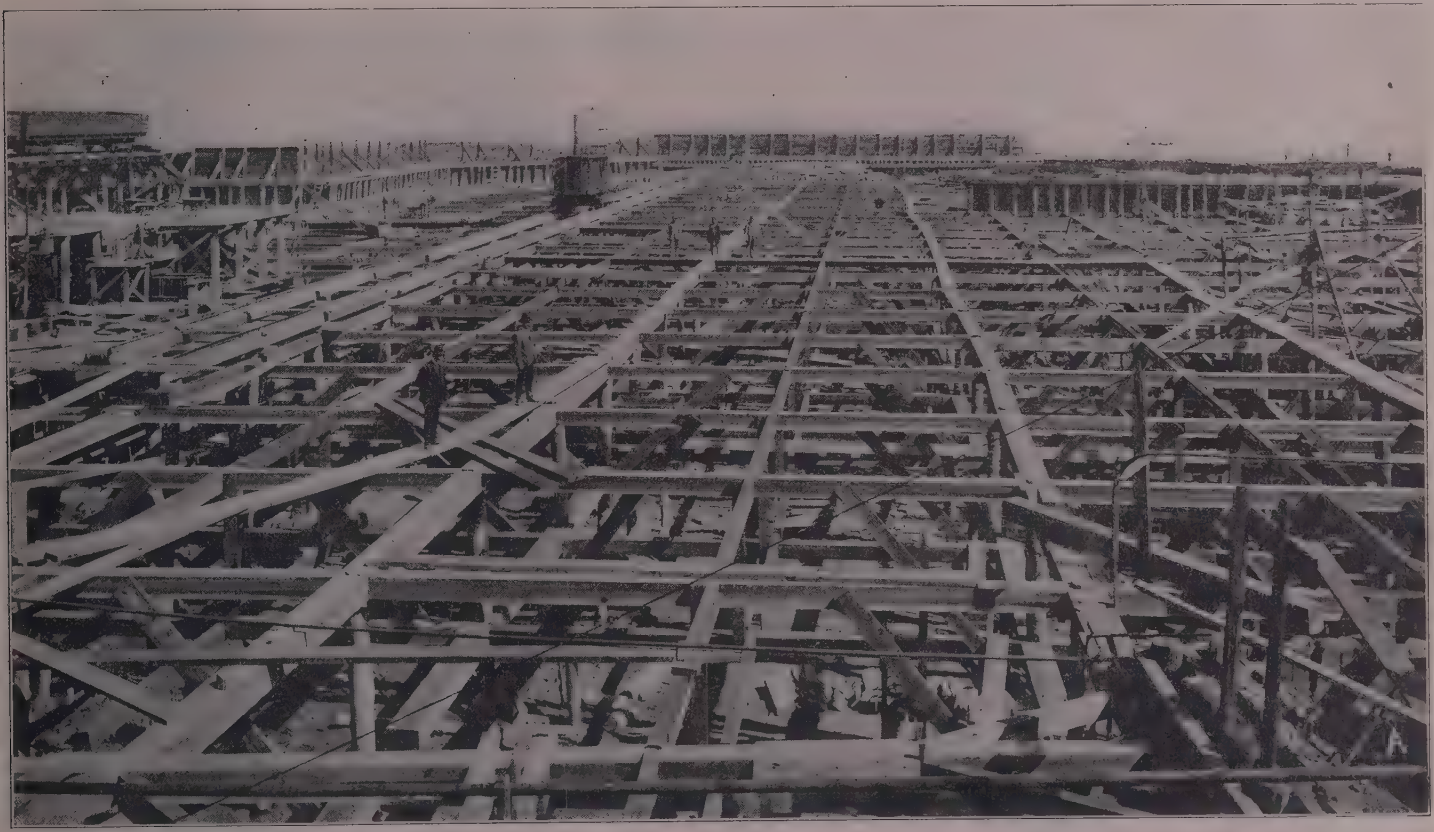
The construction of the superstructure of the building involved no particular difficulties, the materials for it being delivered directly to the site on spur tracks. The machinery is also being delivered on these tracks, one of which is extended into the main machinery room. The building is practically completed. The machinery is being rapidly installed and the smaller centrifugal pumps are expected to be placed in operation immediately. The larger centrifugal pumps and the screw pumps are also in position and will be ready to run in a few weeks.

Since the interceptor on the south side and its crosstown conduit were put in service two 15-in. Lawrence centrifugal pumps in a shed near the 39th St. station have pumped the flow from the former into the conduit through a temporary connection, pending the completion of the pumping station. These pumps have a capacity of about 15,000 gal. a minute and elevate the dry-weather flow coming to the interceptor north of 51st St., which is all that is admitted at present, into the crosstown conduit. The storm water is allowed to back up and overflow into the lake. The temporary connection has been abandoned and these pumps will discharge into the lake for a short time until the interceptor can be connected to the inlet channel of the station and the pumps in the latter started up.

The capacity of the Lawrence Ave. pumping station will be 40,000 cu. ft. per minute, made up in one screw and three centrifugal pumps. The conditions under which this station will run are quite different from those attendant in the south side station. There will be fluctuations in head due to short periods of flood in the north branch of the river, which will be met in somewhat the same way as the variations in head and quantity are met at the latter station. A conduit extending from an intake about 2,000 ft. off shore in the lake to the pumps will supply lake water, and other intakes are planned along the interceptor north of the conduit. The station building will be of brick on concrete footings. The construction is not expected to involve any serious difficulties as the site is in fairly clean sand that extends to hardpan.

The cost of building the two pumping stations and the crosstown conduits is borne jointly by the city of Chicago and the Trustees of the Sanitary District. The work is carried on by the city, but will be maintained and operated by the Sanitary District. The intercepting sewers were built and will be maintained by the city. Mr. W. A. Shaw is engineer in charge and Mr. Wm. S. McHarg is the consulting engineer of the intercepting sewer division of the bureau of sewers, of Chicago. Mr. Joseph W. Patterson is commissioner of public works. Mr. N. A. Sager, assistant engineer in the intercepting sewer division, was immediately in charge of the construction of the 39th St. pumping station. The entire pumping machinery equipment in that station was furnished by the Allis-Chalmers Co., of Milwaukee, Wis. The gates in it were built by the Hansell Elcock Co., of Chicago.

Site of the 39th Street Pumping Station after the Completion of the Permanent Protection Breakwater.



Cofferdam Inclosing the Site of the 39th Street Pumping Station Showing Interior Bracing.

Operating Results at the Dresden Central Heating and Electric Station.

The station built by the city of Dresden, Germany, for supplying electricity for light and power and steam for heating, was fully described in this journal on July 4, 1903. The station is rated at 2,500 h.-p., of which 1,200 h.-p. is for electric purposes. It has now been in operation about three years, and the following figures concerning the results attained in this period were given in a recent issue of "The Engineer," of London.

Because of the distribution of load between heating, the demand for which is heaviest in the daytime, and lighting, an evening load, a double utilization of the boiler equipment is possible. The heating load in daytime averages 14,000,000 calories (30,800,000 B.t.u.) per hour while the evening lighting load does not exceed 7,000,000 calories (15,400,000 B.t.u.) per hour, so that the maximum consumption of energy does not exceed 16,000,000 calories (35,200,000 B.t.u.) per hour. The average number of heating days per year is found to be 250. The heating hours are in general 5.30 a.m. to 10.30 p. m., although during this time some of the buildings are heated only at special intervals; the Opera House, for instance, only needs to be warmed in the morning from 9 a. m. to 10 a. m., and in the evening from 6 p. m. to 10 p. m. The maximum output usually occurs between 6 a. m. and 10 a. m. After 10.30 p. m. to 11.30 p. m. the fires are banked until 5 a. m. or 6 a. m. next morning.

The plant was designed to maintain in all the buildings heated, an inside temperature of + 20 deg. Cent., with a temperature of — 20 deg. Cent. prevailing outside, the total elevation being 40 deg. Gent. (104 deg. Fah.). An inside temperature during winter of 18 deg. Cent. to 20 deg. Cent. (68 deg. Fah.) is adhered to as the standard—which, as stated in the "Engineer," appears a high temperature when it is remembered that with an outside temperature anywhere above 44° Fah. the least robust constitution does not need artificial heat, and which, if introduced with an outside temperature prevailing above 54° Cent., becomes enfeebling. In fact, 54° Cent. is generally sufficient with an outside temperature at freezing point; and 60° is ample with 5° to 10° of frost. But high or excessive heating is the general rule on the Continent, both for buildings and railway carriages. The same practice prevails in the United States, where the demand for heat by central station customers is 70° Fah. to 72° Fah. as a standard temperature—which is often exceeded—and where it is usual to estimate plants for — 20° Fah., and reckon 40 to 50 per cent. of this as the average for the whole heating season. The high temperatures for heating, so prevalent, are to some extent explained by the fact that the efficiency obtained is relatively greater when the plant is being worked near to its full capacity. In fact, when the radiators in a building are adjusted to pass steam rather in excess of actual needs, the loss by condensation due to a downward drop of temperature is less than when they are set to throw off only a moderate heat. A variation of 30 per cent. in the outside temperature may, in the first case, only cause a variation of 12 per cent. in the amount of condensation water; but in the latter case, of low setting, the condensation may be 10 per cent. greater, or a total of 22 per cent. for the temperature variation named.

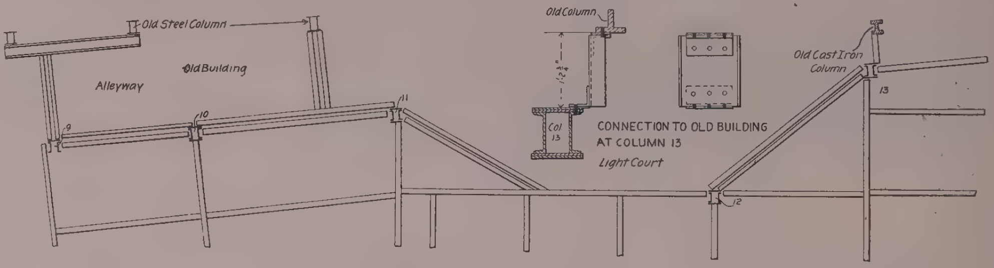
At Dresden, where losses from such causes are unlikely to occur with the perfect organization of the system, as already related, each hundred litres of condensation water (22 gallons) cost, in the first year of service, 45 pfennigs (= 5.4 pence). The average temperature for that year —1902—is not available. But it is obvious that the heating cost must vary very much according to the severity of the cold outside, and to the frequency of the temperature variations. As a whole the ruling climatic conditions of Dresden tend to an economical working of the plant, for there the climate, although not a warm one, may be termed fairly equable, and is not to be classed with continental climates prevailing in countries bordering the Mediterranean, which are subject to extreme differences of heat and of severe cold all in the course of one day. In Dresden the diurnal and annual temperature alternations are not excessive, and the meteorological changes are usually gradual and durable, and therefore well suited for the scope of central station heating with economical results.

In the month of December, during the first year of the station's service, the coal consumption was 1,276,760 kilos., generating 3.677 million calories. The coal used is of the cheapest grades, principally Bohemian lignite or brown coal, which yields 4,000 to 5,000 calories per kilo. The average cost for each 100,000 calories supplied was 29.3 pfennigs (3.5d.) as compared with the cost of 65 or 75 pfennigs with localized central heating installations, and of 70 or 80 pfennigs with ordinary methods of heating rooms by means of slow-combustion apartment stoves, which consume in mid-winter 100 lignite briquettes, costing in retail 70 to 80 pfennigs, in eight days, or 132 hours of absolute heating. Practically, as well as financially, the whole plant and its disposition have proved an unqualified success, particular advantages being attributable to the practice of superheating, the arrangement of subways, mains, etc.

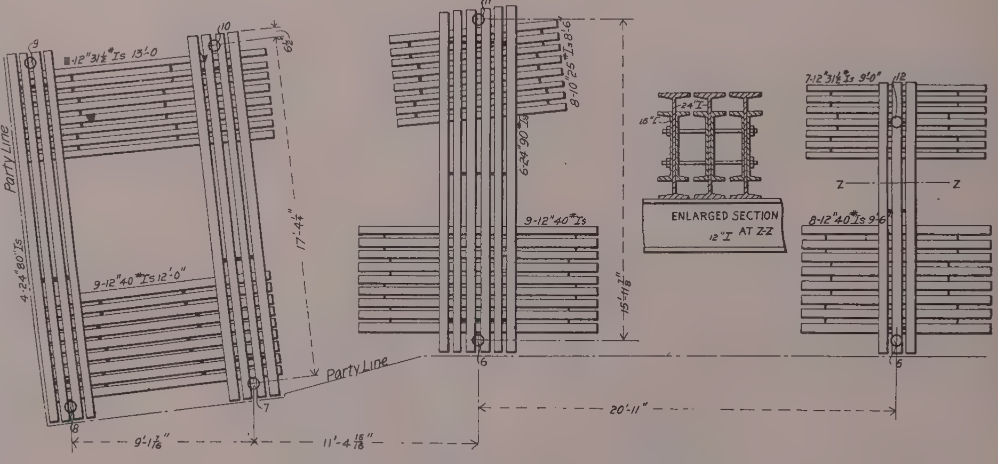
Wood Pulp Grinders have recently been equipped with alternating current motors and are reported to be running satisfactorily. Such installations have been discussed in the paper and pulp industry for several years, but there has always been a pronounced opposition to them. The equipments furnished for a number of grinders by the Westinghouse Electric & Mfg. Co., are consequently of more than usual interest. There is really no serious reason why grinders should not be run by motors, and the delay in introducing them is surprising.

Structural Details in a Maiden Lane Building.

The steel cage building at 35 Maiden Lane, New York, is eleven stories and basement in height and contains about 400 tons of structural steel fabricated and erected by the J. B. & J. M. Cornell Co. I occupies a somewhat irregular area about 91½ ft. long and 17 ft. wide adjacent on one long side to another building of the same height owned by the same persons. The building covers the full area of the lot except for an open light court 31 ft. long and from 4 to 7 ft. wide near the middle of the long side. There are sixteen wall columns from about 9 to 21 ft. apart in two longitudinal rows which carry the wall girders and the transverse floor girders, most of the latter being single I-beams with connections on the center lines of the columns. The longitudinal floorbeams are also single I-beams web-connected to the floor girders and arranged in a simple, ordinary manner except as modified on account of the irregularities of the lot lines and for some special features of bracing.



Wind Bracing Between Old and New Buildings.



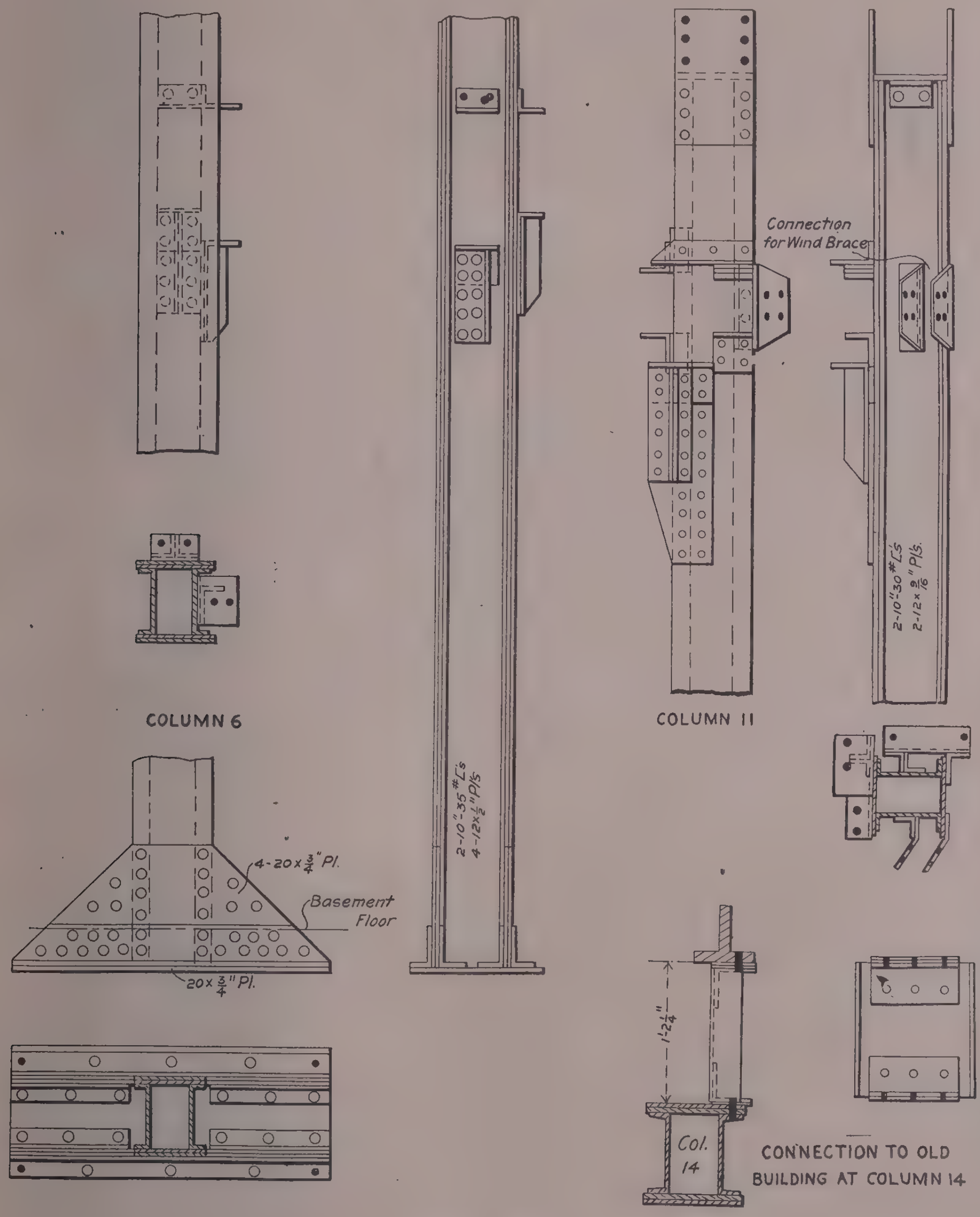
Part Plan of Foundation Girders and Grillages.

There are no intermediate columns and the wall columns being set as close as possible to the lot lines could not have independent extended footings symmetrical with the center of pressure. The soil is quicksand and was excavated only a short distance below the cellar floor to the same level as for the footings of the adjacent building. All footings are made with grillages of 8-in., 12-in. or 18-in. I-beams, bedded in concrete and connected by cast iron separators and tie bolts. The column loads are transmitted to the grillages by distributing girders which overhang them slightly at both ends and support the columns in their required positions independently of their bearings which are arranged to load the grillages uniformly, the center lines of the girders intersecting those of the grillages symmetrically.

In order to distribute the weight of the building over as much surface as possible, and to reduce and equalize the unit pressures on the soil, the whole area of the lot was leveled and covered with a continuous layer of stone concrete 12 in. thick, its surface was waterproofed and more concrete was placed on top in which the lower tiers of grillage beams were bedded. The top of this concrete had a minimum height of 20 in. above the waterproofing but it was made continuous with transverse masses of stone concrete which entirely enclosed the distributing beams in the upper tier of grillages, thus making ribs entirely across the lot on the center lines of the column. The upper surfaces of these ribs were 6 in. below the finished basement, floor level. The spaces between these ribs were filled with cinder concrete up to within 6 in. of the floor level and the whole was covered with the floor concrete 6 in. thick, having a cement finish.

At one street front of the building the corner columns are located very close to both street line and lot line and their loads are combined by making the cantilevers for the two adjacent pairs of columns rest on the same pair of grillages as shown in the accompanying plan of columns 7-8-9-10. At the opposite end of the building the grillage beams could extend much farther beyond the cantilever beams and at one end of the latter each column had separate grillages while at the opposite end the grillage beams were made continuous under both cantilevers merely for convenience, conditions not requiring single pieces. It was, however, more convenient to extend the grillages longitudinally than transversely so that the distance from the cantilevers to the ends of the grillages were more than half the distances between the cantilevers, thus applying the column loads eccentrically on the grillage beams and making the latter act as double cantilevers.

For columns 5 and 12 the footings are arranged as shown in the plan, one grillage center being coincident with the column center so that no cantilever action was developed there and the other one being eccentric and so producing cantilever action. The other intermediate columns were arranged in symmetrical pairs with the distributing beams reaching across the full width of the lot with cantilever bearings on all the grillages like the one shown for column 5.


Connection for Wind Brace
COLUMN 6
COLUMN 11
4-20×3/4" Pl.
Basement Floor
20×3/4" Pl.
2-10"-35# [s 4-12×1/2" Pl's
2-10"-30# [s 2-12×9/16" Pl's.
1'-2 1/4"
Col. 14
CONNECTION TO OLD BUILDING AT COLUMN 14

Column Details.

The distributing beams for columns 5 and 12 were however special in that their webs were reinforced by pairs of channels riveted to both sides as indicated in the enlarged cross section, thus providing increased resistance against the buckling of the web and also giving additional shearing strength and bending moments to the beams which are more heavily loaded than any of the other cantilevers on account of the large proportion of court wall which they carry that is much more massive than the party walls. It was necessary to make these girders narrow so as to secure clearance for the elevator plant and the combination of beams and channels was selected as an effective method of building up the section and securing maximum lateral rigidity with easy riveting and minimum loss of useful section in rivet holes. The space between the webs of all the I-beams are filled with concrete and concrete is packed around the outsides of the webs and flanges to a distance of at least 6 in., thus completely sealing them.

The columns are of ordinary simple construction, rectangular closed cross sections made with pairs of channels, and cover plates, and are in two-story lengths with the splices uniformly 2 ft. above finished floor levels and made with flange cover-plates and with horizontal diaphragms and short horizontal connection angles riveted to the column webs. The beam and girder connections are made with horizontal connection angles engaging the top and bottom flanges of the I-beams. The horizontal legs of the lower angles being in most cases reinforced by bearings on the faced upper ends of single vertical distributing angles.

The feet of the basement sections of the columns are made integral with extended base plates long enough to reach entirely across the cantilever girders and distribute the column load on all the beams in each group. The base plates take bearing on the milled ends of the columns and are stiffened by transverse web plates riveted across the column flanges. In some cases these plates are double, giving a combined thickness of 1 in. and are proportioned as transverse distributing girders to transmit the column load uniformly to all beams in the cantilever girder.

On one long side the building is exposed to wind pressure which was assumed to amount to a maximum of 30 lb. per square foot. If resisted only by the long high and narrow framework this would have necessitated a large amount of horizontal bracing, but it was found practicable to unite the framework of this building with the adjacent old building which as before stated belongs to the same owner, in such a manner that both can be assumed to act together to resist wind pressure and thus utilize the combined mass and lateral rigidity of both buildings which afford sufficient stability without the introduction of much special bracing.

This is effected by connecting the old and new columns in the third, seventh and eleventh tiers. Four new wall columns on one side of the light court are close to and directly opposite four cast iron columns of I-shape cross section in the wall of the old building and are connected to them by short horizontal struts made with single 12-in., 20.5-lb. channels having vertical end flange angles riveted to the new column flanges and tap bolted to the old column flanges. These struts are all substantially alike, but in some cases the connection angles are both riveted to the same side of the channel web and in other cases to opposite sides, as shown in the detail, thus affording some latitude to conform to variations in the relative positions of old and new columns.

At the opposite end of the light court the walls of the old and new building are separated by an open passage or alleyway about 9 ft. wide in the clear, and the struts are carried across this space as shown in the part plan of the eleventh tier of beams. Here none of the corresponding columns are directly opposite each other and the struts take bearing at one end against the column in one wall and at the other end against a horizontal girder with its ends supported on two columns in the other wall. As it was necessary to brace the corner column directly, its brace engages a girder connecting the two nearest riveted steel columns in the old building. The third column in this part of the old wall is intermediate between two columns in the new wall and in this case it was more satisfactory to connect the brace directly to it and have the opposite end engage an extra heavy wall girder in the new wall. The long braces between the old and new buildings are made with a pair of 8-in. channels with their webs vertical and their flanges connected by tie plates. At one end they have short vertical web-connection angles field-riveted to the horizontal girder and at the other end they have their flanges field-riveted between horizontal connection angles across the column flanges. Additional wind bracing is provided for the two columns at the ends of the light court by horizontal knee braces reaching from them to the adjacent column or to the court wall girder at a point where it is stiffened by a transverse beam. These knee braces are made like the braces already mentioned and at each end are connected by field rivets through their webs and through bent jaw plates shop-riveted to the column or to the girder.

The architect of the building was Mr. Louis Korn, Mr. F. A. Burdette was the structural engineer and Mr. F. Larsson was in charge of the detail drawings for the contractor.

Book Notes.

A little text-book which will interest a good many engineers is "Second Year Chemistry," by Prof. Edward Hart, of Lafayette College. It has received the favorable criticism of chemical journals, but none of these reviews indicated the value of the book to engineers. The latter class finds in the ordinary text-book on chemistry too much information about substances with which they never have anything to do, and too little information about those they use, and the same is true of most manuals of chemical analysis. Prof. Hart's book is an outline of a course of qualitative analysis in which elementary chemistry is reviewed and quantitative determinations are made. It is a review of those chemical facts the engineer should either know or have handy for reference. (Easton, Chemical Publishing Co., $1.25.)

At the recent convention of the New England Water Works Association the members and guests were given a volume entitled "Notes on New York City and Vicinity," written by engineers connected with the public works described. It described the water works of the boroughs making up the city and of the important suburbs, rapid transit and railroad improvements in the vicinity, bridges, gas and electric plants, street cleaning, Brooklyn sewers and other civil engineering works. The authoritative character of the information and the fact that it is the only book in which such works are described make it as valuable in its field as the "New York Electrical Handbook," in the field of electrical engineering. (New York, McGraw Publishing Co., $1.00.)

Not long ago the British Home Office prepared a series of draft regulations for docks and wharves. They aroused much opposition and Prof. Henry Adams was retained to give the authorities the benefit of his long practical experience in connection with dock machinery and cranes, with the result that the regulations, when officially issued, were in a modified form, relieving dock owners from the onerous regulations which threatened them at one time. These severe rules referred mainly to testing chains and machinery, a subject on which Prof. Adams is an acknowledged authority, as is evident from a study of his "Use and Care of Chains for Lifting and Hauling." A second edition of this valuable pamphlet, the only one in English relating to the subject, has just been published. In view of the extensive use made of chains in many classes of engineering work, the importance of the information in this book is manifestly great. (London, published by the author, 60 Queen Victoria St., one shilling.)

The fourth edition of Prof. Henry T. Bovey's "Theory of Structures," is such a complete revision of the earlier editions as to be essentially a new book, although the arrangement is the familiar one. It is a comprehensive survey of the principles of elementary structural design, and contains a most complete collection of well-selected practical examples, which in itself is of great value to an instructor. For the benefit of those unfamiliar with the earlier editions it may be stated that it begins with a discussion of framed structures and then takes up successively shearing forces and bending moments, momentum, energy, stresses and strains, elasticity, vibration, thin cylinders, earthwork and retaining walls, friction, the transverse strength of beams, pillars, torsion, bridges, suspension bridges, arches and arched ribs. The properties of materials are given in a number of tables, and on every page it is apparent that the author's aim is to give practical information as well as sound theory. The work is too widely and favorably known to require a long review. (New York, John Wiley & Sons; cloth, 8vo, 981 pp., $7.50 net.)

For nearly twenty years the U. S. Geological Survey has been collecting data concerning the water resources of the country, and its facilities for gathering such information are now so extensive that important statistics of flood phenomena are available. Floods are a serious danger in many localities, but their prevention has not yet received the amount of attention the subject deserves. Those interested in it will find useful statistics in the "Destructive Floods in the United States in 1904," by Mr. E. C. Murphy and others, recently published by the Survey. The floods are described in chronologic order. The first destructive deluge of the year was that on Sacramento River in California, which occurred in February and was the worst in the records of that stream. In March occurred the flood on Susquehanna River, due mainly to ice gorges; the flood of Mohawk River in New York and the flood of Grand River in Michigan caused by the rapid melting of snow; and the flood on Wabash River ascribed to heavy rainfall. In May very heavy rains in northern Colorado and southern Wyoming caused a flood on Cache la Poudre and Cow creeks, which resulted in the loss of considerable property. In the early part of June the Belle Fourche and other streams on the northern slope of the Black Hills were in destructive flood. In the latter part of June and the early part of July, continued heavy rain caused the rivers in southeastern Kansas to rise higher than was ever known before, with the result that much damage was done to property. Several cloudbursts occurred in this month, causing local floods in western Pennsylvania and western Arizona. The floods of Johnstown, Pa., and of the Troxton Canyon, Ariz., are examples of disaster resulting from cloudburst. Very heavy precipitation during the latter part of September and the early part of October in southern Colorado, New Mexico, and Texas caused floods of unprecedented magnitude on Purgatory, Canadian, Pecos, and other streams of that region. After these floods in the western part of the country there was a severe drought in the eastern part. This was felt most keenly in the upper portion of the Ohio drainage basin and to a lesser extent in the Southern and New England States. This drought is briefly described in the report.

The movement of agricultural products for export is one of the most important features of transportation, and, until the recent agitation for the government ownership of railways by means of a public rate-making body, it was the leading subject of discussion among shippers. Unfortunately, it has been practically impossible for most people to obtain a concise unprejudiced statement of the character and extent of this export crop traffic, and, lacking positive information of this nature, opinions concerning it have not been very definite. The great importance of the subject has led the U. S. Department of Agriculture to publish an interesting monograph on the "Crop Export Movement," by Mr. Frank Andrews, its expert in transportation statistics in the Division of Foreign Markets. It gives a brief explanation of the port facilities of the principal seaports on the Atlantic and Gulf coasts and summarizes the statistics of the exports of farm products through those cities. The discussion includes a sketch of the regions of production of cotton, wheat and corn; of the inland centers to which these products are shipped in large quantities, of the general movement of these products to the seaboard and the export movements from the coast cities. The value of such a monograph to students of national economics is self-evident, but is is also important to the far more numerous class of business and professional men who desire to keep in touch with the general trend of commercial development. It is a pretty good refutation of many of the charges that New York is being robbed of its export business by the railroads, which are endeavoring to build up other ports at its expense. If the population of the country remained the same in location, numbers and pursuits, and the export business of New York fell off while it increased elsewhere, then these changes would have greater weight. Mr. Andrews' figures show no such falling off, however; it is true that the percentage of gain in export business has been much greater elsewhere, but the reasons for it are manifestly due to the development of the country's resources west of the Allegheny Mountains, and particularly in the South. For four years the latter region was the scene of civil war which stopped all development, and made necessary a complete reconstruction of a social system of a hundred years standing. In a single generation that problem has been solved and the New Yorker who now travels through the South and fails to see that it is now beginning a career of richly earned prosperity in export as well as domestic trade must be mentally blind.

The work on "Gas Engine Design," by Dr. C. E. Lucke, is a good one marked by faults that thrust themselves so violently on the reader as to cause at first a lack of appreciation of its real merit. Tables giving the horse power of engines to the sixth decimal place and a statement of sixteen different formulas for the thickness of cylinder walls without any hint as to their relative merits are examples of the faults in question. The worst fault of all is the title of the volume, which is not on practical design, in the usual sense, but rather on the theory of design; in other words, it is an explanation of the deduction of formulas rather than their application in practical drafting-room work. This is further indicated by the fact that while there are 145 cuts of indicator diagrams, inertia diagrams and conventional drawings of parts of engines, there is no illustration of an actual engine. The value of the book is only superficially marred, however, by such defects. In the first part the general subject of power, efficiency and economy is discussed at considerable length, and generally very well, although in one or two places some of the definitions require improvement before they are accurate. Definitions are always troublesome to prepare, but their importance warrants spending great care on them, which certainly was not done in the case of the definition of indicated horsepower, to mention a single case. In estimating the mean effective pressure and economy under given conditions, the method of the Thermal

Efficiency Committee of the Institution of Civil Engineers is used, using Dugald Clerk's air standard as a reference diagram. The author apparently considers this method new, but it is diffivult to see any material deviation in it from that of the committee. The collection of indicator diagrams is a valuable one. The inertia of the reciprocating parts, and the effect of the angles of the connecting rod on the balancing of the engine are treated very well, and the same is true of the discussion of turning effort. The latter part of the book contains deductions of formulas for the thickness of cylinder walls, the movement of valves, and the proportions of the leading parts of an engine. It should be borne in mind that all these formulas are essentially empirical even when deduced logically from accurate data. Experience has abundantly proved that all such rules, particularly in the case of large engines, should be tested by comparison with successful precedent before adoption. (New York, D. Van Nostrand Co.)

Handbook of Metallurgy. Vol. I; Copper, Lead, Silver, Gold. By Prof. Dr. Carl Schnabel; translated by Prof. Henry Louis. New York, The Macmillan Co.; cloth, 8vo., 1,143 pp., $6.50.

The first English edition of this authoritative treatise was published seven years ago, and at once stepped into well deserved favor. Since it first appeared, metallurgy has made giant strides, which made it necessary to rewrite many sections of the original text and enlarge practically every part. Consequently, this new edition merits review as a new book, particularly as it is the only really comprehensive work on the subject in English. The author's object has been to give a complete account of the metallurgical treatment of all metals in common use, except iron, together with all recent improvements in the art. While doing this he points out the scientific principles underlying each process and illustrates it by examples drawn from actual practice in various parts of the world. This is particularly easy for the author because of his extensive travels in America, Asia and Australia, which have given him personal acquaintance with most of the important metallurgical establishments throughout the world.

The first 369 pages are devoted to copper, and the treatment of this metal is characteristic of the discussion of the three remaining metals taken up in this volume. The physical and chemical properties are briefly stated, an explanation is given of the chemical reactions of the compounds of copper that are of importance in its extraction, and the properties of the important copper compounds are described. The production of crude copper is then taken up in detail in two sections of the book, the first describing dry methods of smelting and purification, and the second wet methods, including electrochemical methods, of extracting copper. It is unnecessary to follow the author's explanation of the various processes he describes, as this would be merely a list of the many methods used in different countries. His plan of treatment is excellent, and makes the book invaluable for reference. Each subject is first explained and the leading differences of the various systems it presents are pointed out. In some cases the author criticises their respective merits. Then he explains each system and describes plants where it is in use. The references to American practice are so frequent as to indicate the importance attached to them by German metallurgists, and the growing influence of electrochemistry in the domain of metallurgy is frequently emphasized.

The metallurgy of copper, lead, silver and gold is treated in the first volume because these metals so frequently occur together in the same mineral deposits that they are often necessarily extracted side by side from their ores, and also because their treatment has been so profoundly modified by recent improvements that more space is required for a description of the methods employed in their extraction than for that of all the other metals, which will form the subject of the second volume, to appear next year. The value of the work as a reference book is materially enhanced by a geological index in addition to a good general index, and it will be found a valuable and authoritative addition to any engineering library.

Steam Boilers; their History and Development. By H. P. Powles. London, Archibald Constable & Co.; cloth, 24s.

In view of the fact that the steam-generating part of a power plant has by no means received as much attention as the steam-using portion, a thoroughly good book on boilers, like this, deserves a warm welcome. It is not only a history of the boiler industry but also a record of failures which, if studied intelligently, will throw much light on some of the phases of steam generation that are not recognized by many inventors of even the present time. The history begins, of course, with Hero's combined boiler and engine, which is inevitable in any book on the subject, and then jumps two centuries to hot water heaters found at Pompeii, which the author for some reason classifies as boilers. There is then a jump of fifteen centuries to the alleged record of Blasco de Gary's steamboat used at Barcelona. From this time the record is more complete, and about every boiler of note designed prior to 1853 is described in the first eleven chapters. These pages show that high pressure was advocated as far back as 1801, but defective materials and workmanship prevented its practical development for many years. Naturally enough Trevithick's work receives much attention, for in boiler designs he fully deserved the author's characterization as "certainly a bold or reckless man, or probably that happy combination of both qualities often found in great inventors and in pioneers into new fields of research."

The twelfth chapter is a discussion of plain Cornish and Lancashire boilers, and includes a description of the new dish-ended Lancashire type of Thompson. It may be said, in fact, that practically no distinctive type of boiler used in Great Britain, however recent it may be, is omitted from the records of this volume. Some of the freak boilers of German and American inventors are not included, but the book is not hurt by the omission. The thirteenth chapter relates to locomotive boilers, and is particularly interesting as showing how thoroughly good was the "Rocket's" boiler, which has not been essentially changed in all the years since it brought great fame to Stephenson. The fourteenth chapter is on marine boilers, and here the reader is at once impressed by the extraordinary persistence with which low pressures were maintained. This was due to the weakness of the box boilers in use, but there seems to have been no reason other than blind conservatism that prevented the use of Scotch boilers and higher pressures long before 1862. But if this change was slow in beginning it presaged a more rapid development in boiler practice than on shore, and we must look on board ship to-day for high-pressure working. The fifteenth, sixteenth and seventeenth chapters are on vertical, sectional and fire-engine boilers. The last type is a very old one, for a true flash boiler was invented 165 years ago by John Payne, who also conducted some surprisingly successful experiments to determine the density of steam. About 75 years ago John Braithwaite spent about $100,000 in endeavoring to introduce the steam fire engine in London, but was unsuccessful.

The three chapters on the water-tube boiler are among the most important in the volume. The first patent for this type was taken out in 1805 by Stevens and a number of other patents were granted at fairly frequent intervals afterwards, but the real development of the water-tube boiler has occurred in recent years. It has been so rapid, moreover, and so different in Great Britain from the progress in other countries that American readers will find this part of the book of special value. There is a full account of Yarrow's elaborate experiments on circulation, which deserve much more attention in the United States than they have received. A short chapter on the boilers for automobiles rounds out the discussion of types.

The final chapter is a review of and commentary on the historical data previously given, and is enhanced in value by a very good bibliography of the steam boiler. Mention should also be made of fifteen plates of sections of the most important boilers, arranged in chronological order in groups of similar types. Five of the plates show water-tube boilers. The book as a whole is one that should be in every reference library, while the engineer who aspires to be something more than a scientific mechanic will find it worthy of a careful reading.

Letters to The Editor.

The Glover Sewage Patents.

Sir: I note in your editorial of Sept. 16, 1905, the statement, "any engineer who built a system in accordance with the original Glover idea, after the experience already had with it, would be crazy." You very kindly published in the Record of May 9, 1896, an illustrated article entitled, "A Small Sewage-Disposal Plant," setting forth Glover's original ideas as disclosed to the public at that time, which was four days after the issue of his much discussed patent now before the court. The reproduction of the article and cuts at this time will be of interest to engineers generally. The apparatus depicted purports to be designed "to purify the sewage at the county farm, of Rockingham County, N. H." "The system used is that of the Glover Sanitary Sewage Co."

The population at the county farm averages about the same from year to year; and the amount of sewage is about 20,000 gal. per day, such as originates in a residential quarter, as at Champaign, Ill. The total capacity of the tanks is 10,474 gal., or 12 hours' flow. The sewage is received in the first tank of one series with a capacity of 3,490 gal. by a submerged inlet, thence flows into a second tank with a capacity of 1,745 gal. by way of a pipe through the dividing wall near the bottom of the tank, clearly indicating that there would be very little permanent deposit of sludge in the first tank, where most of it would be disposed of. From the second tank of the series the clarified and partially purified effluent escapes by a midway pipe to an oxidizing filter-bed where the rate of filtration is 700,000 gal. per acre per day.

Mr. Frank Herbert Snow stated before the American Society of Civil Engineers, when Mr. Leonard Metcalf's paper on "The Antecedents of the Septic Tank" was under discussion, that "Mr. Glover did claim an absolute disappearance of all solids either in the central tank of the system, or the subsequent filters grouped around the tank." Your statement that "the patentee was plainly ignorant of the real nature of the changes that take place in sewage when it stands in tank" would undoubtedly be reversed could you read the testimony in the case.

The tanks called "collecting tanks" in the Brentwood drawings are the "primary filter-beds" of the patent "of any suitable construction" to meet the specified functions thereof.

Mr. Snow claims that the "primary filter-beds" of the patent are the sludge beds, which are not shown in the drawing issued to disclose to the public Glover's original ideas. He is quite sure of this fact because Glover told him so; and he believes that Glover got the idea of the sludge beds from the Brockton sludge beds, which were, in fact, first used as sludge beds in November, 1895, two months after Glover applied for his patent.

Mr. Glover was such a bad man with his innovaion that it required special legislation to suppress him, as stated by Mr. Snow in the Metcalf discussion: "The evil of allowing fake systems to demonstrate their inefficiency at public expense, in preference to taking sound professional advice, has been obviated in Massachusetts by reason of the fact that plans must first be approved by the State Board of Health, whose standards of comparison afford no encouragement, but rather keep the promoter away."

I was Glover's professional adviser through the summer and fall of 1895, following Mr. Snow, and succeeded by Mr. B. T. Wheeler. I do not have to depend upon my memory to show Glover's original ideas; it is a matter of documentary evidence supported by numerous reliable witnesses. It has taken about 1,000 pages of evidence and exhibits to place our case before the court—and the end is not yet. The gist will be given to the public when the court is through with it.

Yours truly, John N. McClintock.
Boston, Nov. 2.

[As the present editor of The Engineering Record was not connected with the journal in 1896 and has no knowledge of the source of the article referred to above, he wrote to the superintendent of the Rockingham County Farm for information about this disposal system. The reply, dated Nov. 6, is as follows: "The Glover disposal plant at this place has never worked satisfactorily and the County Commissioners have never been satisfied with it. I think it is a failure in every sense.]

Seating the Pedestals of Bridges.

Sir: In all bearings I am using practically exclusively rust cement joints between the pedestal castings and the masonry. In my experience this has given excellent satisfaction. I have used them even in such joints as that between the track castings of a heavy turntable of a draw span and the masonry, where the rolling effect of the load is considerable. I doubt whether under such circumstances pure cement or sheet lead would stand. The first would have a tendency to crumble; the second to flow and destroy the uniformity of bearing.

Recently I have taken out rust cement from under the castings of the old Bismarck bridge superstructure which was constructed by Mr. Geo. S. Morison. The cement came out in large slabs, some of them as much as 2 ft. in diameter and was almost as hard as an inferior quality of cast-iron would be. This cement has been in the bridge for twenty-two years.

I have used it under the turntable of the Rock Island draw where the draw span weighs nearly 2½ million pounds. This was used ten years ago and no sign of any weakening or crumbling has yet appeared, and I have no doubt that it will continue in good condition indefinitely. I have used sheet lead under plate girders and smaller spans, but I generally prefer the rust cement joint as it is entirely free from the objections of flowing or crumbling under load and has the advantage of allowing the joint to be packed uniformly before setting, thus insuring a uniform distribution of pressure over the masonry.

Very truly yours,
Chicago, Oct. 30. Ralph Modjeski.

The Air Space in Grates.

Sir: Having read the editorial in The Engineering Record of Oct. 28 in regard to air space in grates, I write to ask your opinion as to how a test of the effect of different spacing should be carried out and any information that would aid in securing reliable results. In finishing my course in mechanical engineering in the Iowa State College, I am taking up this subject and expect to make a number of tests for thesis work. As near as I can say at present, we will equip at least one boiler with some form of grate that will allow us to vary the air space for different tests.

Very truly yours, L. C. Way.
Ames, Ia., Nov. 7.

[Such a test, if comprehensive and carefully conducted, will yield results of so much value that the letter is printed in this place in order to secure suggestions from all interested in the subject. Prof. Wm. Kent stated clearly in a letter printed last week the necessity of keeping a great number of conditions constant in such tests, and mentioned specially the size of coal, depth of coal bed, depth and kind of ashes or clinker on grates, draft in chimney, damper openings, size and kind of gas passages through the boiler, ashpit door opening. If such conditions can be kept uniform through a number of tests with grates having different percentages of air space, the results should be of considerable practical value.]

A Foundation Problem.

Sir: On page 131, second column, vol. 52, of the Record, mention is made of the Masonic Temple in an article on Chicago foundations. Will you or one of your readers very kindly inform me where I can get information concerning the theory that settlement or sinking of foundations in uniformly soft or compressible soils depends, for its total amount, as much on the width of the concrete beds as on the intensity of pressure per unit of area of the bed. For instance, in a building erected by me, I was able to load a bed 15 ft. wide 20 per cent. more per square foot than adjoining beds 6 ft. wide, obtaining very nearly the same measure of settlement. The soil, of course, carried in neither case the ultimate load it was capable of bearing. The subject is a fascinating one and I should be very greatly obliged by being told where I can obtain materials for its study.

Faithfully yours, Civil Engineer.

[The reference in this letter is to a passage in a lecture by Mr. E. C. Shankland, reading as follows: "In the Masonic Temple four of the main columns, near the lifts, carry heavy loads and have large footings, and between them are two small columns which carry only the stairs. As these had much smaller footings than any others in the building, they were given a higher load per square foot. During the construction of the building the four columns had received the greater portion of their loads when the erection of the stairs was begun. It was found at once that the connections on the stairs would not fit those on the columns, the latter being too high. Levels taken to ascertain whether the small columns had been forced up, showed that they simply had not settled with the rest of the building. About 75 tons of pig iron were then loaded on both footings and allowed to remain for a week. Although the load then amounted to 7,000 lb. per square foot, twice the load on any of the other footings, the column only settled about 1 in., less than one half the desired amount, and so the connections had to be changed all the way up the stairs." In a general way, engineers who have much work to do on poor materials make some distinction between compressible foundations and those which yield sideways. In the former, of which thick, soft clay probably affords the most common examples, the amount of settlement depends largely on the unit load and less on the area of the footings. In the soils which yield sideways with or without compression, the area of the footings and the extent to which the soil is confined laterally are of most importance. So far as The Engineering Record is aware the only book on the subject is Delafield's "Foundations in Compressible Soils," one of the professional papers of the Corps of Engineers, U. S. A., which is not available for general circulation. Any information concerning cases of such unequal settlement as the writer mentions will be welcomed in these pages.]

Wooden Pavements.

Sir: When in your city last summer I noticed that a number of streets were being paved with wood setts, one of them being in front of your own offices. Several of these streets have some inclination and seemed to be well traveled, so that they will give an opportunity to those interested in the matter for observing the unfitness of such setts for paving grades. Of course, it is possible that the surveyors on your side may find some means to keep the pavements safe for the horses, but we have never been able to do it here, except by costly and constant cleaning, which makes wood setts an extremely expensive luxury.

We are using these pavements for two reasons. One of these, to avoid the noise of granite setts, is as important with you as with us, although, in my opinion, it is vastly overrated by most people. The second reason is the fact that our asphalt is the slippery rock asphalt and not your artificial sheet asphalt, which gives a better foothold and is an ideal paving material where stone setts are not required. Your surveyors, I might add, apparently do not care for good stone setts, for I saw none in your city that would be rated as even second class with us. With such rough surfaces you cannot possibly secure a good stone pavement with narrow joints, and, I think your New York authorities ought to put down one street with really good stone setts before they adopt wood extensively.

People told me that these wood carriage ways were a comparative novelty in your city and so I imagine you have not yet learned that they must be kept very clean in order to be passable. A little film of mud and a little dash of rain will make them as slippery as a waxed floor. As they are a novelty, I would suggest that some instructive figures could be obtained any rainy morning by counting the number of accidents in the street in front of your offices and the number on any street of similar slope with a different pavement. I think these figures would show that our urban councils have gone daft over wood.

Sincerely yours, W. P. Biggs.
Westminster, Nov. 3.

[These wooden pavements were laid at the request of the teamsters' association in the city, after some experience with such blocks on a sloping street leading to one of the leading ferries. This particular pavement was certainly slippery last winter and sprig, but the action of the organization representing the city's trucking interests is proof that those parties most interested in pavements as users of them, are at present in favor of wood, even on grades.]

The Power Plant of the Union Railway Station at Washington will be equipped with four 500-kw. Westinghouse-Parsons turbo-generators. These will use dry saturated steam at 150 lb. pressure and 25 in. vacuum, unusual conditions in turbine practice which will make the results of operation worthy of careful test.

CURRENT NEWS SUPPLEMENT

NOVEMBER 18, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, meeting, Dec. 6; paper on New Graving Dock, at Nagaski, Japan.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers.. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

American Society of Refrigerating Engineers. Sec-Annual meeting, Dec. 4-5; 12 West 31st St., New York.

National Association of Manufacturers of Sand-Lime Products. Secretary, H. A. Duerr, Wilmington, Del. Next meeting, Dec. 5-7, Detroit.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia, Pa.

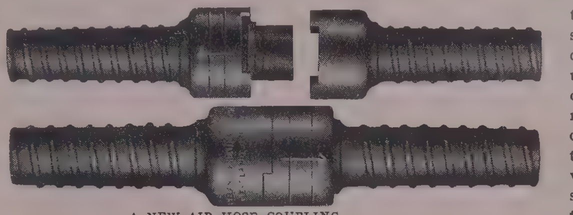
PIPE COVERING LITIGATION.

Judge Coxe, of the U. S. Circuit Court for the southern district of New York, has decided the equity action for the infringement of the famous Hanmore patent for non-conducting coverings, in favor of the Keasbey & Mattison Co. This patent was for a "non-conducting covering or jacket composed of molded tiles or sections of a composition which includes as its non-conducting element a major proportion of carbonate of or calcined magnesia, and which also includes a sufficient quantity of fibrous material, such as asbestos fiber, to bind the magnesia together, the magnesia in any case forming of itself the principal non-conducting element of the composition." In explaining his claims Hanmore mentioned a mixture of 75 per cent. of carbonate of or calcined magnesia, 20 per cent. of asbestos, and 5 per cent. of plaster of paris as conforming with the composition he wished to patent. Such a mixture was very light and highly non-conducting, and differed, he claimed, from previous mixtures in which less magnesia was used. This pipe covering proved very satisfactory and about 1900, the Philip Carey Mfg. Co. and the American Magnesia Covering Co. put similar coverings on the market which were the subject of the action recently before the court.

It was asserted that one reason for the patent remaining unattached so many years after it was issued was because its owners had a practical monopoly of the magnesia industry. Judge Coxe grants that the fact the Keasbey & Mattison Co. was a large producer of magnesia might have made it unprofitable for small manufacturers, especially in the immediate vicinity, to compete in the covering business, but the proposition that it was impossible to infringe "is based upon imagination rather than upon proof." Acquiescence by the public in a patent for almost its entire life, while not conclusive, is persuasive evidence of its validity, and is entitled to great consideration, somewhat approximating that accorded to a prior adjudication.

As regards the state of the art in 1885, Judge Coxe decides that pipe coverings containing fossil meal, lime putty, clay, plaster of paris and paper pulp were then old and the properties of magnesia as a non-conductor were well known. None of the earlier patents for compounds containing magnesia anticipate the Hanmore patent. Neither the fireproof and waterproof plates of Nagel, the roof boards of Brigham, the water-cooler lining previously patented by Hanmore, nor the magnesia-plastered cork pipe of Ordway infringes the claims of the patent in suit, and there is nothing about them to suggest to the skilled mechanic the steam pipe covering in question. One single case of prior use was claimed by John Andrews to have occurred in 1878, a quarter of a century prior to the giving of his testimony. On this testimony Judge Coxe makes the following criticism:

"If his testimony is to be accepted as accurate, at the age of 32, and at the commencement of his business career as a manufacturer of steam pipe coverings, he had knowledge of the Hanmore combination. The question naturally arises, Is it likely that if he had this 'potentiality of becoming rich' within reach he would have permitted it to slip from his grasp? No physical exhibit of the Andrews covering is shown except a so-called sample, which, it is asserted, was placed in a drawer of Andrews' desk in 1878 and remained there until 1903. It is unnecessary to attempt a minute analysis of this testimony. It presents the old situation which arises where human memory is relied upon to establish unimportant and trivial events and circumstances occurring a quarter of a century before. Andrews and the other witnesses, who agree with him in some more or less unimportant features, may be correct, but on the other hand they may be mistaken, but the inherent improbability of the testimony in its entirety, and the fact that Andrews' memory is shown to be exceedingly defective in other matters, compels the court to the conclusion that no impartial mind can be convinced of the truth of this testimony beyond reasonable doubt."



A NEW AIR HOSE COUPLING.

Other criticisms and objections were raised by the defendants, but the court decides that infringement against them was abundantly proved, and a decree against them for an accounting on all claims of the Hanmore patent, with costs, was granted to the Keasbey & Mattison Co.

A NEW AIR HOSE COUPLING.

In shops where pneumatic tools are employed, the importance of some hose coupling which can be made and unmade quickly is thoroughly appreciated. To meet the demand for such a device the Cleveland Pneumatic Tool Co., Second and Hawthorne Aves., Cleveland, has recently put the Bowes coupling on the market. The accompanying illustrations show it coupled and uncoupled. To take it apart, it is only necessary to slip a sleeve back, give the two parts a quarter turn and pull them apart. The coupling is rendered tight by a U-shaped gasket inside the female end. When the coupling is made, the pressure of the steam, air or water within the fold of this gasket presses one side of it against the male and makes all parts tight. The device is made in many sizes, some of which are interchangeable. In shops where there are many pipe connections for the hose, a plug can be attached to each connection by a light chain and thus be kept ready for use at any time.

Some excellent circulars have recently been issued by the Electro-Dynamic Co., Bayonne, N. J., which is giving in these publications the answers to the requests for information made by its own representatives and by customers. No. 15, for example, gives in compact form a statement of the power requirements of a great number of machine tools. No. 16 is a full explanation of the manner in which sparkless commutation is obtained in the Interpole variable speed motor and contains reproductions of the dimension cards used by the company's salesmen in stating the sizes of motors of various capacities. No. 17 is a concise statement of the advantages of individual motor-driven machines in shops.

MR. SHONTS' ADDRESS ON THE ISTHMIAN CANAL.

At the joint meeting of the American Hardware Manufacturers' Association and the National Hardware Association at Washington, on Nov. 9, Chairman Theodore P. Shonts made the following address on the Panama Canal, which is of interest as a reply to criticisms of the conduct of affairs on this work during the last year:

When I received Mr. Lupton's invitation to come before your association and talk on the Panama Canal, I accepted it with pleasure because of the opportunity it afforded of talking to business men in a business way of what is a great business project. As I view it the building of the Panama Canal is a business, not a political proposition. I propose, in what I have to say to you, to talk as a practical man to practical men who are themselves engaged in large commercial enterprises, and who know from experience the difficulties to be met and the enormous amount of thought and labor involved in the inauguration of great undertakings in the United States. You will be able to appreciate, therefore, how every difficulty was aggravated in an enterprise of the magnitude of the isthmian canal, in which the preparatory work had to be carried on 2,000 miles from the base of supplies. But this is not all. The work had to be done in a hostile climate and under health conditions which, through centuries of neglect of all sanitary principles, had become a menace to the lives of all persons save natives of the tropics.

In order, therefore, to make the isthmus a place fit to live in and to work in there were three fundamental tasks which had to be performed in advance of all others.

First, Thorough sanitation of the isthmus.

Second, Providing suitable habitations for all classes of employees.

Third, Providing a system of food supply which would afford to all employes opportunity of obtaining wholesome food at reasonable cost.

First, Sanitation.—In regard to sanitation: When the United States began this work there were no systems of waterworks, of sewerage or of drainage on the isthmus. The people depended laregly on unprotected cisterns for their water supply, filled during the rainy season, and on barrels filled from neighboring streams, all breeding places for mosquitoes. The filth of ages had accumulated around the dwellings and in the streets undisturbed except when washed away by torrential rains. Pools of stagnant water had existed for years in proximity to dwellings and insect-breeding swamps lay undrained adjacent to the cities and many of the towns. Seventy per cent. of Panama is now supplied with pure mountain water, fed from a storage large enough to furnish 60 gallons a day to each inhabitant after its present population shall have increased one-half. Fifty per cent. of a complete modern sewerage system has been installed, and work on the remainder is being carried rapidly forward. The first million of brick for paving its streets are on the ground. The city has been fumigated time and again, first house by house, to stop the spread of disease, and again as a unit, that is, the entire city at one time. A large force is just finishing a thorough cleaning of the city—the first scrubbing it has had during its centuries of existence; and Governor Magoon, under whose jurisdiction all this work has been accomplished, is arranging to raze many of the worst shacks and replace them with modern sanitary buildings. Within a year it may confidently be predicted, Panama will be a city well watered, well sewered, well paved, and clean and healthy.

What has been done for Panama is being done for Colon and every important labor camp across the isthmus. Work on Colon's water reservoir is well under way, and temporary measures are being employed to safeguard the city's health pending the report of a board appointed to recommend plans for permanent improvements. An abundant supply of pure water from mountain springs has been provided at Culebra and at other important labor centers along the line of the canal, and aaequate drainage is being installed in them also.

Four thousand one hundred men are now employed in these sanitary undertakings. So effective has been the work that yellow fever has been virtually extirpated from the isthmus. In June last there were 62 cases of yellow fever there; in July, 42; in August, 27; in September, 6, and in October, the worst month of the year for yellow fever, 3—no one of the latter among the employes, and all originating many miles from the line of the canal. In regard to general health conditions, I was told, when on the isthmus in October, that there were over a hundred less patients in Ancon Hospital than there had been for many months, although we had brought in 4,000 additional laborers during the previous two months, and it was from the new arrivals that the hospitals were usually recruited.

To fully understand what has been accomplished by our sanitary work it is only necessary to compare the present rate of sickness with that which prevailed on the isthmus when the French were in possession. In August, 1882, the second year of the French occupancy, with a force of 1,900 men, the death rate was 112 per 1,000. In August, 1905, with a force of 12,000 men, there were only eight deaths, or two-thirds of a man per 1,000.

If we have not, as our critics complain, made "the dirt fly," we have made the filth fly, and we have made yellow fever, that supreme terror of the tropics, fly so far from the isthmus that it will never, let us hope, find its way back again. We have established a hospital system which includes a large hospital at Colon and another at Ancon, and a number of smaller hospitals at convenient points along the line. The one at Colon is built on piers over the Atlantic Ocean, and patients there have at all times the benefit of cool and invigorating sea air. That at Ancon is one of the largest and best equipped in the world, situated on the hill above Panama and commanding a superb view of mountains and sea.

The management and service of the hospitals are on a par with the natural advantages and beauty of location. Colonel Gorgas, who is in direct charge of hospitals, has organized a staff of doctors and nurses for which it would be difficult to find a superior anywhere. Isham Randolph, one of the members of the consulting board of engineers, who recently visited the isthmus, said, in a letter published on his return: "The hospitals are a source of just pride to our people. If sickness could ever be regarded as a boon, it may be so thought of in Ancon and Colon." No less emphatic testimony comes from D. M. Hazlett, who speaks from personal experience as a patient in Ancon hospital. Writing in the Panama Mail, he says: "The medical staff and corps of trained nurses are beyond criticism. No expense has been spared in providing the various wards with all the conveniences which science and experience can command. There is probably no institution in the world where patients receive better treatment or more faithful service than in Ancon Hospital."

Second, Quarters.—In regard to providing quarters for the employes. The commission inherited from the French company more than 2,100 buildings, all in bad condition. During the past year 649 of them have been repaired; 58 new buildings have been erected and 67 more are in course of construction; two new hotels, three stories high and containing from 55 to 60 rooms each, have been completed, and authority has been granted for eight others, a portion of which are under construction at the present time. Work is in progress also on cottages for married employes and on bachelor quarters. In this work of construction 2,400 men are employed, and additional carpenters are being sent out with every steamer. This work is being pressed forward with the utmost vigor.

Third, Commissary.—In regard to food supplies. This was the most serious problem that confronted us. If we couldn't feed the men, we couldn't build the canal. Owing to the fact that the natives never look beyond their present necessities, no surplus food supply ever accumulates. This normal condition of no surplus was greatly intensified by the almost total failure of the crops for the two preceding years, by the abandonment by agricultural laborers of their farms back in the hills for work on the canal, where they received higher pay for shorter hours, and by quarantine against the port of Panama on account of bubonic plague, which prevented the arrival of food stuff from neighboring provinces.

We were thus brought face to face with the problem of feeding 12,000 men, with base of supplies 2,000 miles away.

We immediately arranged to open local commissary stores at every important labor camp, to provide mess-houses, and to furnish food, both cooked and uncooked, to all employes at cost. We cabled orders to have our steamers equipped with refrigerating plants; we arranged for the erection of a cold storage plant at Colon, and we purchased refrigerator cars for immediate shipment to the isthmus, thus establishing a line of refrigeration from the markets of the United States to the commissary stations of the isthmus. We also purchased from individual lessees the equipment in existing hotels, and assumed their management ourselves. The net result of these efforts is that to-day we are affording to all employes opportunity to obtain an abundant supply of wholesome food, cooked and uncooked, at reasonable prices. The silver men—by which I mean the common laborers—are being fed for 30 cents a day, and the gold employes—by which I mean those of the higher class—at 90 cents a day, and it is good food in place of bad. There may be dispute about the blessing of tainted money, but there can be none about the curse of tainted meat.

Railroad.—But in addition to these fundamental tasks of improving the health conditions on the isthmus and providing for the physical comfort and well being of all classes of employes, another essential preliminary to actual canal building has been receiving our earnest attention. I refer to the enlargement and improvement of our facilities for receiving and distributing the immense quantities of materials and supplies which will enter into the construction of the canal, as well as into the work referred to. The only really valuable instrument essential to canal building acquired by our government in its purchase from the French was the Panama railroad. But this instrument, like all the others whose wrecks cover the isthmus, had been neglected and its equipment allowed to become obsolete. If the docks, wharves, warehouses, terminal yards, locomotives and cars of the Panama railroad had been in good repair, which they were not, they still would have been entirely inadequate to properly care for and handle the small commercial business the road was transacting. The existing facilities, poor as they were, were rendered less efficient by the entire absence of any mechanical appliances on the docks to assist in receiving or discharging the steamer's cargoes. The negro laborer was the only power employed; he was at once the only hoisting machine and the only traveling crane in use. Imagine, then, the congestion which necessarily ensued when the accumulated orders in the states began to arrive in large quantities on both sides of the isthmus. To aggravate the situation, while the deluge of arriving material was at its height, the commercial business of the road increased nearly 50 per cent. over the year before; and at the moment when we thought affairs could get no worse, two cases of bubonic plague at La Boca resulted in two consecutive quarantines at that place, completely tying up that outlet for sixty days. Furthermore, the personnel of the Panama railroad as acquired had not been educated on modern lines, and therefore was completely paralyzed when confronted with the onerous conditions caused by this congestion. It was necessary, consequently, to begin at once the construction of new wharves equipped with modern mechanical appliances, and of large terminal yards at both ends of the road; of extensive warehouses; of suitable machine shops, and of a modern coal hoisting plant, which will reduce the cost of handling coal from ship to engines from $1.30 to about 12 cents per ton.

We have also purchased new and more powerful locomotives, larger cars for both passenger and freight services, and heavy steel rails for relaying the road, and have strengthened the bridges to enable them to carry the heavier equipment. We have reorganized the personnel of the road, putting into the higher positions experienced, aggressive, up-to-date men, with the result that with the old equipment and facilities they have cleared up during the last 30 days an accumulation of over 12,000 tons of commercial freight. With the advent of our increased dock facilities, terminal yards now nearly complete, and new power and equipment now arriving, the road will be in a position to handle efficiently and economically a vastly larger volume of business than heretofore.

Construction Plant.—While all this necessary work was in progress, the task of purchasing, forwarding and distributing the enormous quantity of materials and supplies of all kinds was receiving our constant and most careful attention. The purchases included not only the items entering into the permanent plant, but also those required for the preliminary work. To give you an idea of the magnitude of these purchases I will read for you the principal items:

Sixty-one steam shovels, 1,300 flat cars, 12 rapid unloaders, 22 unloading plows, 13 earth spreaders, 324 dump cars, 12 hoisting engines, 120 locomotives, 5,000 tons of steel rails, 125,000 cross ties, 12,000 pieces of piling 14 air compressing machines, 3 cranes, 152 rock drills, 30,000,000 ft. lumber (approximately), 2 dipper dredges, 646,000 lb. blasting powder, 617,500 lb. dynamite, 7,000,000 paving brick, 3,500,000 building brick, 500,000 sq. ft. roofing tile, 36,000 bbls cement (approximately), 3 steel water tanks and towers, 12 stand pipes, 2 ocean steamships.

The approximate total cost of our purchases was about $9,000,000. It should be borne in mind that at the time when orders for most of these items were placed the industries of the United States were crowded with domestic business, and were unable, consequently, to make prompt deliveries. It should be borne in mind also that after machinery had been manufactured here and set up it had to be taken apart, shipped 2,000 miles over steamship lines already taxed to their full capacity, and on arrival on the isthmus had to be again set up before ready for use. Then, too, on account of many reports as to the prevalence of yellow fever on the isthmus, it was very difficult at a critical time for concerns furnishing material to get steamers to take it there, because of fear that their crews might become infected and their vessels might be quarantined when they wished to return to the United States. Finally, the steamers of the United Fruit Line from New Orleans, which had been carrying a considerable amount of the freight going to the isthmus, were put out of service on account of yellow fever in that city.

To the various causes of delay mentioned is to be added the requirements of law that all bids for materials used in government work shall be advertised for. This compels a delay in all cases of from 10 to 30 days.

Furthermore, in addition to the purchases for the canal, the following have been ordered for the Panama railroad:

Five hundred box cars—40 ton, 12 caboose cars, 10 refrigerator cars, 6 passenger coaches, 24 locomotives, 2 wrecking cranes, 1 locomotive crane, 1 pile driver, 3 track scales—100-ton, 1 modern coal hoisting plant, 1 cantilever crane for coal hoisting plant.

In regard to all equipment purchases, both for the canal and the railroad, it should be stated that the gauge of the Panama railroad, being wider than the standard gauge in the United States made it impossible to use second-hand rolling stock of any kind; all locomotives and cars had, therefore, to be built to order. After the supplies reached the isthmus we had to contend not only with the lack of terminal facilities and mechanical appliances already mentioned, but also with an inadequate equipment with which to distribute it to its destination or the force to handle it. These obstacles have been largely surmounted. The elimination of yellow fever and the establishment of better systems of housing and feeding the employes have enabled us to recruit our working forces till those assigned to the material and supply division now number over 2,100 men.

Present Work.—I have so far, gentlemen, endeavored to give you an idea of the difficulties which we have had to encounter and overcome in order to make the isthmus a place fit to work in, and to collect the tools with which to work. So far as actual excavation and dredging are concerned, we have not endeavored to accomplish much. As a general principle, in which I think you will all concur, it is inadvisable to attempt to run a railroad before the tracks are laid. We are now working, however, six steam shovels in Culebra cut, which is the largest single factor in the construction of the canal, and have removed approximately 1,000,000 cu. yd. of material. By this work we are accomplishing two things: First, we are putting the levels of the cut in proper condition for the installation of the largest number of machines which can be effectively operated; and, second, we are gathering data which will be useful in future estimates of the cost of canal construction. In the Culebra work 2,600 men are now employed. We are also building railway tracks and yards, and are dredging at both ends of the canal, so far as advisable until the question of type of canal is decided, and this should be determined within the next 90 days. It should be understood that all the work we have done is applicable to any type of canal.

Labor.—The question of labor is a grave and perplexing one. We have advanced far enough to know that we can secure a sufficient supply of labor from the tropics, so far as numbers are concerned. The question of quality is a very different matter. Unless a much greater efficiency can be developed than is secured at present, we shall have to look elsewhere. Probably I can best convey to you a just estimate of the quality of this labor by relating an incident which came under the observation of Senator Millard during his visit on the isthmus: Sitting on the deck of the steamer Havana, he was watching the unloading of a heavy piece of machinery from the hold of the vessel. The tackle got caught in the rigging on the deck above; the foreman in charge of the gang of laborers sent one of them above to free the tackle. The laborer went to the place to which he was sent, and did what he was told to do. The foreman, paying no attention to him after he started on his errand, missed him a few minutes later, and, looking around for him, discovered him sitting peacefully at the spot to which he had been sent. "What are you doing there?" yelled the foreman. "You told me to come here, sah." "Well, why didn't you come back?" "You didn't tell me to, sah."

It is to this class of labor that we are paying from 80 to 90 cents per day in gold, and out of which it is estimated we do not get more than 25 per cent. of the efficiency of labor in the United States. This is the kind of labor to which we are compelled to apply the eight-hour law—that is, to aliens who know nothing of the law's existence until they arrive on the isthmus. Such application will increase the labor cost of canal construction at least 25 per cent., and will add many millions unnecessarily to the total expenditure. In my opinion it is a mistake to handicap the construction of the Panama canal by any laws save those of police and sanitation. I want to go on record here that the application of the eight-hour law, of the contract labor law, of the Chinese exclusion act, or of any other law passed or to be passed by Congress for the benefit of American labor at home, to labor on the isthmus is a serious error. Over 80 per cent. of the employes of the canal will be in a clerical or supervisory capacity. The application of these laws on the isthmus will benefit a very small number of American laborers, but will enormously add to the cost of construction, and American labor at home will have to pay its share of the consequent increase in taxation. As business men you will understand the force of the statement.

That is the story, gentlemen, of what we have been doing on the isthmus. In line with this, let me add that Chief Engineer Stevens, a man well equipped for the great task he has undertaken, is preparing three complete sets of plans applicable to as many types of canal; so that when decision shall have been reached as to what type of canal will be used, no delay in beginning work will ensue. It is our confident belief that by the first of July next the plant as purchased will be installed and working to its fullest practical capacity. In other words, by that time the dirt will begin to fly in earnest.

Opposition.—The canal will be built—rest assured of that—and it will be built at Panama. Those two phases of the problem have passed irrevocably from the field of debate. There is an industrious and voluble band of hired Ananiases moving to and fro in the land whose mission it is to deny this. The burden of their song to the accompaniment of their lyres is, "The canal will never be built at Panama, and everybody connected with the enterprise, including the president, and commissioners, and engineers, is convinced of it." You can hear the members of this band chanting their song, singly and in chorus, wherever men congregate, and wherever a few reporters are gathered together. They are rehearsing for their grand burst of noise when Congress shall have assembled. When they are not rehearsing they are putting the words of their song into bogus interviews and other written forms of newspaper publication, which they are sending forth by thousands from their bureaus of publicity in this and other cities. As one contemplates the output of this singular industry, this factory of fiction, he is moved to say of its guiding spirit, as Shakespeare says of Capt. Dumain: "He will lie with such volubility, sir, that you would think truth were a fool."

Who is capitalizing this industry? What is the bountiful source of this spouting spring of mendacity? Is it to be found among the friends of an isthmian canal? Are these supplying funds for the sustenance of such a campaign of misinformation? What interests, except those foolishly dreading the competition of an isthmian canal, would put up money to delay and possibly defeat its construction? That there are interests of that kind is not a matter of suspicion or speculation, but of history. They have been fighting a canal for more than half a century, and they fought it successfully till Theodore Roosevelt, armed with his "big stick," appeared as its champion. From that moment their efforts have been powerless, but they have not yet discovered the fact. They are wasting their energies and their cash, for behind Theodore Roosevelt stand the American people in solid mass and with determined front, shouting as one man. "Give us a canal that will be adequate to meet the demands of the commerce of the world, and give it to us at the earliest possible moment." That, gentlemen, is the command which the commission, under the inspiring lead of the President, is obeying to the letter. We are building the "Roosevelt canal."

MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The fifty-second meeting of the American Society of Mechanical Engineers will be held in New York City during the first week in December. The headquarters instead of being at the Society House, 12 West Thirty-first St., as in previous years, will be at the Edison Building, 44 West Twenty-seventh St., the two upper floors being used. The opening session, at which President John R. Freeman will present the annual address, will be at 44 West Twenty-seventh St., on Tuesday evening, December 5. The second or business session will be held Wednesday morning in the main saloon of the steamship "Amerika," at the docks of the Hamburg-American Line at Hoboken, N. J. Following this session a special train will take those desiring to make the excursion to the new Henry R. Worthington Hydraulic Works at Harrison, N. J.

Wednesday evening there will be an illustrated lecture at 44 West Twenty-seventh St., by Prof. R. W. Wood, of Johns Hopkins University, on "Photography of Invisible Phenomena." The third session will be on Thursday morning, at 44 West Twenty-seventh St., and besides the presentation of professional papers there will be a discussion on the subject of bearings. Thursday afternoon there will be a reception at the New York School of Automobile Engineers, 146 West Fifty-sixth St. The usual reception at Sherry's will occur on Thursday evening. The closing session will be at 44 West Twenty-seventh St., on Friday morning, and will be devoted to the presentation of professional papers.

BUSINESS NOTES.

The B. F. Sturtevant Co., Boston, Mass., has recently sold for export to Porto Rico, a complete forced draft equipment for burning bagasse. The company has also recently supplied to the American Woolen Co., Maynard, Mass., the largest fan in New England for induced draft purposes. Other recent sales of Sturtevant mechanical draft apparatus are to the Illinois Central R. R., Chicago; Cleveland-Cliffs Iron Co., Ispheming, Mich.; Jefferson County jail, Louisville; Eaton, Cole & Burnham, Bridgeport, Conn., and the U. S. Custom House, New York City.

On the Simplon tunnel, although the driving was done by Brandt hydraulic drills, compressed air was used by the locomotives and was furnished from the power house at Brigne, where two class BC3 Ingersoll-Sergeant compressors, driven by water wheels, were installed.

The Western Electric Co., New York and Chicago, has begun the construction of a large three-story warehouse at Atlanta, Ga., where the company will maintain an important branch office under the charge of Mr. O. D. Street.

G. M. Gest, the expert subway contractor of New York and Cincinnati, has been awarded the contract for the construction of a complete subway system at Chattanooga, Tenn., for the East Tennessee Bell Telephone Co. Active work on construction of this contract was commenced this week and is to be rushed to a speedy conclusion. This is the first conduit work installed in Chattanooga and the system will be a large one.

The Westinghouse Electric & Mfg. Co. will have a new line of ceiling and floor column fan motors on the market the coming season, both direct and alternating current. These fans will have four blades and ball bearings, and be finished in black enamel and oxidized copper. The alternating current fans will be of the induction type and the direct-current fans will be furnished with three-point switches. The regular line of alternating and direct current desk and wall bracket fans will be as complete as requirements demand.

In response to the demands of its clients, the Electrical Testing Laboratories, New York, has installed a machine for testing some of the mechanical properties of conductors. The rated capacity of this machine, in the measurement of tensile strength, is 15,000 lb., which is sufficient to break a No. 0000 hard drawn copper wire. By this addition to its equipment the company now has excellent facilities for all such tests of wires and cables as are ordinarily required in electrical practice. These comprise measurements of conductivity, insulation, resistance, dielectric strength, electrostatic capacity, tensile strength, elongation, elastic limit, etc.

The Concrete Steel & Tile Construction Co., 1 Madison Ave., New York, is desirous of receiving catalogues of tools and construction machinery.

At a meeting of the directors of the Taylor Iron & Steel Co., in New York City, on Oct. 31, several changes were made among the executive officers. Mr. Lewis H. Taylor resigned as president and was succeeded by Mr. Robert E. Jennings, of Jersey City, N. J., who has been vice-president since the company was organized in 1891. Mr. Percival Chrystie was elected vice-president to succeed Mr. Jennings. Mr. Knox Taylor was elected general manager. The officers at present are as follows: President, Robert E. Jennings; vice-presidents, Percival Chystie and Dr. Henry M. Howe; secretary and treasurer, T. F. Budlong; general manager, Knox Taylor. Mr. Lewis H. Taylor has been president and director of the Taylor Iron Works and the Taylor Iron & Steel Co. since the former company was organized in May, 1868. For several years he has been anxious to relinquish the presidency, but the directors were unwilling to have him do so until the present time, when he insisted that his age was such that he should be relieved of all care and anxiety in business matters. In accepting Mr. Taylor's resignation the board unanimously elected him honorary president. Mr. Robert E. Jennings has been well and favorably known in iron and steel circles for a great many years, having been formerly connected with the Spaulding & Jennings Co., of Jersey City, N. J., later with the Crucible Steel Co., of America, and still later as receiver of the Carpenter Steel Co., of Reading, Pa. Upon reorganization of the latter company some months ago, Mr. Jennings was elected its president, which office he now holds. Mr. Percival Chrystie has been connected with the Taylor Iron Works and the Taylor Iron & Steel Co. in various capacities since 1887 and Mr. Knox Taylor has been with the company for the past four years. Mr. Chrystie and Mr. Knox Taylor make the fifth generation of the Taylor family who have been interested in the manufacture of iron and steel in Hunterdon County.

PERSONAL NOTES.

Mr. C. D. Bowman, of West Montrose, Ont., has been elected engineer of Guelph Township.

Mr. George W. Tonson has been elected a member of the Board of Public Service of Toledo, Ohio.

Mr. E. C. Buchanan, of Little Rock, Ark., has been appointed chief engineer of the Pine Bluff, North & South Ry.

Messrs. Olmsted Brothers, Brookline, Mass., have been retained to prepare plans for the development of the grounds of the Ohio State University at Columbus.

Mr. E. E. Turner succeeds the late J. T. Denithorne as division engineer of the Valley Division of the St. Louis, Iron Mountain & Southern Ry., at Monroe, La.

Mr. Robert McF. Doble, consulting engineer, of San Francisco, has severed all connection with the Abner Doble Co., in order to devote all his time to private practice.

Mr. J. L. Harrington read a paper before the Canadian Society of Civil Engineers on Thursday on the wharf cranes of the Pennsylvania R. R. at Greenville, N. J.

Mr. Russell L. Huntley has been appointed acting chief engineer of the Union Pacific Ry., succeeding Mr. Berry, who resigned recently to become chief engineer of the Rock Island system.

Mr. George W. Fuller will read a paper on the most suitable methods for the disposal of sewage on the Atlantic Coast at the meeting of the New Jersey Sanitary Association at Lakewood on Dec. 9.

Mr. N. D. Phelps has been appointed sales manager of the Mining, Crushing and Cement Machinery Department of the Power & Mining Machinery Co., succeeding Mr. T. H. Tracy, who has resigned.

Mr. E. E. King has been appointed division engineer of the Pacific & Idaho Northern Ry., with offices at Weiser, Idaho.

Mr. Beauchamp H. Smith, second vice-president of the S. Morgan Smith Co., York, Pa., died at his home in Los Angeles on Nov. 1. He was 35 years old, and had lived for the last five years on the Pacific Coast, where he went for the benefit of his health.

Mr. E. O. Clarke has been appointed division engineer, Division of Municipal Engineering, Isthmian Canal Commission, succeeding Mr. Carleton E. Davis, who recently resigned to join the engineering staff of the Board of Water Supply of New York.

Mr. Herbert C. Burchell has been compelled to resign the office of director of public works of British Honduras on account of the effects of the climate on his health. He will return to Newfoundland and enter the government service of that colony again.

Mr. Charls H. McCullough, Jr., has been elected vice-president and general manager of the Lackawanna Steel Co., with offices in Buffalo. He has been assistant to Pres. Clarke of the company for some time, and before that was connected with the Illinois Steel Co.

Mr. John T. Simpson, for seven years chief engineer of the Hay Foundry & Iron Works, Newark, N. J., has resigned that position, to take effect Jan. 1, in order to devote his entire time to the interests of the American Concrete-Steel Co., of the same city, of which he is treasurer.

Mr. W. S. Harer has been appointed division engineer of the Idaho Division of the Oregon Short Line, assuming the duties formerly discharged by Mr. J. P. Congdon, who has been appointed supervising engineer of the work coming under the chief engineer on the operated lines of the company.

Mr. Edward L. Boyd has been elected borough engineer of Tamaqua, Pa., and will have entire charge of all street work as well as other public improvements. Hitherto the street work has been under a supervisor, elected to the office for political reasons, but this plan has been so expensive and unsatisfactory that the above change has been adopted.

Mr. Allen R. Gilchrist has been appointed city engineer of Montgomery, Ala., succeeding the late D. W. Ford. He graduated from the Thayer school at Dartmouth in 1890, and has been engaged exclusively in the South for the last ten years, mainly on construction. At the time of his appointment he was in charge of work on a ship slip at New Orleans for The Foundation Co., New York.

Frederic Henry Betts, an eminent specialist in patent law, died at New York on Nov. 10. He was born in Newburgh in 1843 and was admitted to the bar from Columbia Law School in 1866. He was counsel in very important patent suits for the Western Union Telegraph Co., American Bell Telephone Co., Edison Electric Light Co., General Electric Co., Westinghouse Electric & Manufacturing Co., Westinghouse Air Brake Co., Marconi interests and others.

Mr. Edwin P. Hawley, recently promoted to the position of engineer of construction of the New York, New Haven & Hartford R. R., with offices in New Haven, is well known among bridge designers as one of the first railway engineers to foresee the necessity of heavy bridge construction in order to obtain reasonable permanence. He secured his early engineering experience in the city engineer's office in Providence, which he left in order to become engineer and superintendent of a long distance telephone company in southern New England. A little more than twenty years ago he was associated with Gov. Henry Howard in the study of the railway facilities of Providence, and a little later was appointed chief engineer of the New York, Providence & Boston R. R. In conjunction with Mr. S. L. Minot, chief engineer of the Old Colony R. R., he designed the stations and track arrangements there, which were later constructed and remained in use down to the time of the recent alterations by the New Haven company. When Mr. Hawley was appointed chief engineer of the New York, Providence & Boston R. R., there was not a steel bridge on the line, but under his direction the old wooden structures were replaced by metal bridges of unusual weight for their time. A large portion of the line between Stonington and New London was double-tracked under his direction and numerous facilities of one sort or another were constructed in the vicinity of Providence. When the road was absorbed into the New Haven system, Mr. Hawley's responsibilities were considerably extended, and later he was called upon to devote much of his time to projects for the elimination of grade crossings. For a number of years he has been located at Boston with the rank of assistant chief engineer, and has devoted his attention mainly to the lines east of Willimantic and New London. In his new office he will have charge of all the construction on the New Haven system.

By the death of David Maxson Greene on Nov. 9, the engineering profession has been deprived of one of its oldest and best -known members. He was born in 1832, and was a descendant of John Greene, who was associated with Roger Williams in establishing the settlement at Providence, and of Rev. John Maxson, the first white child born in Rhode Island. He was graduated from the Rensselaer Polytechnic Institute in 1851 and spent a year there as an instructor, leaving this work to join an engineering corps engaged in enlarging the Erie Canal. The next year he went West to take part in railway surveys and construction, when he was obliged to give up this work about two years later on account of ill-health. In 1855 he was appointed an instructor at the Rensselaer Polytechnic Institute and a little later was promoted to the rank of full professor, which he held until 1861. In that year he joined the engineer corps of the U. S. Navy and was detailed for about a year on sea duty. He was then transferred to the Naval Academy as assistant professor of physics and instructor in steam engineering, and remained there until 1865 when he was transferred to the Bureau of Steam Engineering at Washington. He remained engaged in steam engineering work in the Navy Department until late in 1869, when he resigned and returned to Troy to take up civil engineering practice. He was connected with a number of municipal and State works, and in 1874 was appointed deputy State engineer, a position he held until 1878. The following year he was elected director of the Rensselaer Polytechnic Institute and discharged the duties of this onerous position for thirteen years, resigning in 1891. During this period he also carried on a considerable practice as consulting engineer and court expert. He always took an active interest in public affairs. He served as a school commissioner of Troy from 1873 to 1876 and was on several of the commissions which were necessary from time to time to straighten out the evil conditions of the city.

George Robert Stephenson, who died at Cheltenham on Oct. 26, was one of the few engineers able to say that he was a pioneer railway builder in every sense of the term. He was born in 1819, and was a nephew of George Stephenson. When he was twelve years of age he went to work as a mine surveyor for his father, then chief engineer of large collieries near Manchester. His father was building a winding engine at the time and this gave the boy an opportunity to acquire practical acquaintance with details of this sort at an age and period when such knowledge was practically unique. He returned to school when he was sixteen years old and remained at his studies for two years before entering his famous uncle's employ. His first work was on a part of what is now the Lancashire & Yorkshire Ry., then under construction. When this work was finished he was appointed chief engineer of the Tipton Collieries. He did not remain there long, however, for he was soon afterward engaged on work for his uncle, as a sub-resident engineer. When he was twenty-five years old he opened an office for himself at Westminster, and was later connected with many railways, not only in Great Britain, but also in her colonies and in other countries. He also built a number of important bridges, although he never took the same interest in bridge construction as in railway work. One of these structures was the famous Victoria bridge of the St. Lawrence, which was replaced a few years ago. Later he became associated with the firm of Robert Stephenson & Co., of which he eventually became the head. In 1899 he retired from business.

TRADE PUBLICATIONS.

The album of views of structures built with Old Dominion Portland cement, which has been issued by the Wm. C. Hartranft Cement Co., Real Estate Trust Bldg., Philadelphia, proves what a wide field is being developed by concrete at the present time. The beautifully printed pictures show concrete buildings ranging from modest houses to the great Atlanta Terminal Passenger Station, covered filters, pumping stations, reservoirs, buildings of hollow concrete blocks, dams, chimneys, culverts, canal walls and locks, bridge piers, sidewalks and other structures too numerous to mention. The book also contains the standard specifications for Portland cement of the American Society for Testing Materials.

The Watson-Stillman Co., 46 Dey St., New York, has issued a unique catalogue describing hydraulic accumulators and a few valves designed specially for use with them. This is probably the only catalogue restricted to this subject that was ever issued, yet the variety of apparatus described is so great that it has been found necessary to divide the machines into eight types, many of them having a considerable number of variations. Some of the machines illustrated have never before been described, while the explanation of others, such as the hydro-pneumatic accumulator, has been entirely recast.

CONTRACTING NEWS
OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Abbeville, Ala.—This town is reported to have contracted with Engineer Jos. B. McCrary, of Senoia, Ga., for the construction of water works to cost about $20,000.

Guntersville, Ala.—The Mayor writes that it is proposed to construct water works, at a cost of $5,000. No engineer employed as yet.

Phoenix, Ariz.—The $300,000 bonds of the city have again been sold to W. R. Todd & Co., of Cincinnati, O. After election of Mayor, which will take place in about 90 days, action will be taken looking toward complete construction of municipal water works, with supply from wells; or the purchase and rebuilding of present private plant.

Eureka Springs, Ark.—The Eureka Springs Water Co., of Eureka Springs, has been incorporated, with a capital of $50,000. Incorporators—M. T. Gear, John Jones and others.

Perry, Fla.—Bids will be received by the Mayor and Bd. of Councilmen until Nov. 28 for furnishing material and constructing water works, as advertised in The Engineering Record.

Toccoa, Ga.—At a citizens meeting in Oct. a committee was appointed to look into the question of constructing water works; probable cost, $30,000. Committee will report Nov. 27.

North Platte, Neb.—Bids were opened on Nov. 8 at the office of the U. S. Reclamation Service, Denver, Colo., for the construction of concrete culverts, siphons, drops, flumes, wasteways, bridge abutments, etc., and furnishing 10 combination highway bridges and 570,000 lbs. steel, the work to be done along the line of the Interstate Canal from Whalen to Torrington, Wyo., in connection with the North Platte project, Neb., to be known as the first contract; bids were submitted in two schedules: (*a*) W. O. Morrison, Denver, Colo.; (*b*) Guy F. Atkinson, Colorado Springs, Colo.; (*c*) Robinson & Maney, St. Louis, Mo.:

Schedule No. 1.	*a*	*b*	*c*
570 cu. yds concrete, Class 1	$5.30	$7.00	$11.00
430 cu. yds. concrete, Class 2	10.80	10.00	15.00
1,800 cu. yds. concrete, Class 1, in floor and side walls or flood water intake	5.10	6.00	11.00
28,000 lbs. steel for reinforcing	.0275	.05	.0475
90,000 lbs. I-beams	.0375	.05	.045
600 lbs. Clinton wire fabric	.099	.10	.06
5,000 lbs. lattice girders	.058	.06	.05
80 cu. yds. puddle	1.20	2.00	1.50
40 cu. yds. grouted paving	5.50	4.00	5.00
200 cu. yds. rip rap or dry rock paving	4.30	4.00	4.00
100 cu. yds. screened gravel for boulders	1.30	2.00	3.00
8,000 cu. yds. excav., Class 1	.38	.40	.50
400 cu. yds. excav., Class 4	3.00	4.00	2.00
5 M. ft. common lumber	34.00	50.00	45.00
Total	$27,070	$31,735	$44,646
Schedule No. 2.	*a*	*b*	*c*
4,200 cu. yds. concrete, Class 1	$6.60	$8.00	$11.00
2,700 cu. yds. concrete, Class 2	10.90	11.60	15.00
285,000 lbs. steel for reinforcing	.0327	.04	.0475
120,000 lbs. Kahn bars for reinforcing	.0468	.045	.04
27,000 lbs. lattice girders	.055	.06	.05
15,000 lbs. Clinton fabric or equivalent	.099	.10	.06
200 cu. yds. grouted paving	5.25	5.00	5.00
200 cu. yds rip rap or dry rock paving	4.30	4.00	4.00
900 cu. yds. gravel-boulder backing for concrete lining	2.30	2.00	5.00
3,000 cu. yds. screened gravel and boulders	2.20	2.50	4.00
1,500 cu. yds. puddle	1.25	1.50	1.50
15,000 cu. yds. excav., Class 1	.36	.60	.30
100 cu. yds. excav., Class 2	.72	1.25	2.00
100 cu. yds. excav., Class 3	1.26	4.00	2.00
100 cu. yds. excav., Class 4	4.00	2.00	2.50
5 M. ft. common lumber	36.00	40.00	45.00
8 66-ft. span highway bridges, ea	1,018.00	1,150.00	1,250.00
2 60-ft. span highway bridges, ea	980.00	1,050.00	1,200.00
Total	$103,806	$119,430	$145,628

Toledo, O.—Bids were opened Nov. 6 by the Bd. of Pub. Service for the construction of Sections 1 and 2 of the filtered water conduit. Totals of bids for Section 2 were as follows: (1) open cut tile lining; (2) tunnel tile lining; (3) open cut mortar face lining; (4) tunnel mortar face lining: (*a*) Henry P. Burgard, Buffalo, (2) and (4), $52,160; (*b*) Thos. McKinney & Sons, Toledo, (1) $74,120, (2) $55,270, (3) $68,320, (4) $49,470; (*c*) W. J. Gawne, Cleveland, (2) $46,046, (4) $43,871; (*d*) H. P. Streichler, Toledo, (1) $73,910, (2) $51,290, (3) $68,010, (4) $45,635; (*e*) A. Bentley & Sons, Toledo, (2) $40,567, (4) $42,407; (*f*) Breyman & O'Neill, Toledo, (1) $84,352, (2) $46,072, (3) $78,552, (4) $40,475.

The following are the bids submitted for Section No. 1:

Section No. 1—Filtered Water Conduit.

	a	*b*	*c*	*d*	*e*	*f*
4,100 ft. open cut tile lining	....	$23.00	....	$23.50	....	$28.00
4,100 ft. tunnel tile lining	$16.00	16.50	$14.25	15.70	$11.90	14.80
4,100 ft. open cut mortar face lining	....	21.00	....	21.50	....	26.00
4,100 ft. tunnel mortar face lining	16.00	14.50	13.50	13.75	11.90	12.87
50 tons reinforcing steel rods	75.00	130.00	75.00	100.00	140.00	50.00
200 cu. yds. additional concrete	9.00	8.00	6.00	9.00	6.80	5.00
20. M. ft. plank flooring	45.00	60.00	35.00	40.00	28.00	21.00
4 manholes	350.00	200.00	285.00	150.00	350.00	150.00
75 ft. blow offs	7.00	12.00	3.35	6.00	1.80	250.00
Totals						
Open cut tile lining	....	$105,300	....	$105,000	....	$119,507
Tunnel tile lining	$73,975	$78,650	$65,466	$73,020	$59,245	$65,387
Open cut mortar face	....	$97,100	....	$96,800	....	$111,307
Tunnel mortar face	$73,975	$70,450	$63,391	$65,025	$61,705	$57,474

New York, N. Y.—Bids were opened on Nov. 8 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains in Columbus, 9th Aves., 62d St., Central Park West and in Central Park. The folowing are the totals, which include valves and hydrants, also unit prices on some of the items: (*a*) Clinton Beckwith, 49 W. 27th St., $498,443; (*b*) F. V. Smith Contr. Co., 147 E. 125th St., $450,450; (*c*) Norton & Dalton Contr. Co., 27 W. 140th St., $529,875; (*d*) John Cornwell, Jr., 69 E. 127th St., $590,225; (*e*) Gallo & Pittelli, 127 Mulberry St., $582,639; (*f*) M. O'Brien, $537,796, and (*g*) P. Goodman, 1668 Park Ave., $614,410.

	a	*b*	*c*	*d*	*e*	*f*	*g*
7,800 tons straight pipe	$30.00	$29.00	$30.00	$31.00	$33.00	$27.50	$32.00
500 tons special castings	60.00	60.00	65.00	60.00	70.00	61.00	70.00
5,500 cu. yds. rock excav. (without blasting)	6.00	3.50	5.00	6.00	5.00	9.00	20.00
2,500 cu. yds. rock excav	3.00	3.50	5.00	4.00	3.00	3.00	3.00
1,000 cu. yds. masonry excav	1.50	3.50	1.50	2.00	.01	9.00	4.00
64,000 cu. yds. earth excav	.60	.55	.75	1.00	1.00	.60	1.25
54,000 cu. yds. of fill and embankment	.30	.10	.50	1.00	.20	.45	1.25
1,100 lin. ft. 60-in. pipe	2.00	2.20	2.50	3.00	4.50	4.00	2.50
14,500 lin. ft. 48-in. pipe	1.50	1.60	2.00	1.50	4.50	3.00	2.00
5,300 lin. ft. 36-in. pipe	1.00	1.00	1.00	.80	2.00	2.00	1.50
250 lin. ft. 30-in. pipe	1.00	1.20	1.25	1.20	2.00	.75	1.50
100 lin. ft. 24-in. pipe	1.00	1.10	1.00	.90	2.00	.60	1.00
700 lin. ft. 20-in. pipe	.75	.80	.75	.70	2.00	.60	1.00
23,000 lin. ft. 12-in. pipe	.50	.50	.50	.60	.80	.25	.50
6,500 lin. ft. 6-in. pipe	.30	.25	.30	.30	.40	.20	.25
2 20 x 20-in. connections	350.00	225.00	325.00	350.00	500.00	200.00	300.00
2 20 x 12-in. connections	250.00	100.00	150.00	200.00	300.00	140.00	200.00
3 20 x 6-in. connections	125.00	50.00	100.00	150.00	250.00	120.00	150.00
7 blow-offs to set	10.00	10.00	25.00	40.00	20.00	15.00	50.00
100 lin. ft. of 24-in. vitr. drain pipe	3.00	2.00	2.00	2.40	3.00	1.00	3.00
100 lin. ft. 18-in. vitr. drain pipe	2.00	1.50	1.00	1.40	3.00	1.00	3.00
200 lin. ft. 12-in. vitr. drain pipe	1.50	.70	.75	.60	2.00	.90	2.00
3,000 lin. ft. 6-in. vitr. drain pipe	1.00	.30	.50	.30	1.00	.50	1.00
750 cu. yds. brick masonry	15.00	10.00	18.00	12.00	.01	15.00	18.00
750 cu. yds. concrete masonry	8.00	5.00	10.00	6.00	3.00	10.00	8.00
300 cu. yds. rubble masonry	6.00	4.00	4.00	4.00	.01	4.00	5.00
300 cu. yds. dry stone masonry and rip-rap	2.50	1.50	1.50	2.00	.01	2.25	5.00
50 lin. ft. park wall	16.00	2.00	5.00	6.00	.01	.01	5.00
3,500 cu. yds. puddling	.65	1.00	1.00	.50	.01	.90	1.50
2,500 sq. yds. sodding and garden mold	.40	1.00	.50	2.00	.01	.10	1.00
6,200 sq. yds. asphalt pav't & asph't or artifical stone sidew'k	4.00	3.00	3.50	3.50	2.00	4.00	3.00
250 sq. yds. granite block pav't. on concrete found., tar and gravel or cement joints	2.00	1.50	2.00	1.50	2.00	2.00	3.00
1,500 sq. yds. telford macadam pav't., driveway, bridle and foot paths	1.00	1.75	1.00	1.40	1.00	1.75	1.00
19,000 sq. yds. pav't and flag	.40	..	.50	.40	.50	.25	.75
2,500 lin. ft. curb and gutter	.10	.10	.10	.01	.01	.10	.25
10 M. ft. sheet piling and timber	25.00	40.00	40.00	40.00	10.00	45.00	50.00
6,000 lbs. wrought iron or steel, installed complete to place	.03	.04	.10	.10	.05	.02	.05

**Items marked thus give the names of parties awarded contracts.*

Apalachicola, Fla.—Bids will be received until Dec. 5 at the office of the City Council for $40,000 water works bonds and $10,000 sewerage bonds. For further information, address M. Brash, Secy. Bd. Pub. Wks.

Adairsville, Ga.—Jos. E. McCrary, of Senoia, is stated to have been selected to prepare a map of town and specifications for the construction of water works. Probable cost, $20,000.

Nampa, Idaho.—Claude Duval, City Clk., writes that bids will be received Dec. 11 for construction work required in connection with water works and sewerage system; probable cost of proposed improvements is $27,000. No engineer selected as yet.

Bloomington, Ill.—Bids are wanted Nov. 24 for laying water mains on Olive and Taylor Sts. Elmer Folsom, City Engr.

Abbeville, La.—The Town Council is reported to have on Nov. 7 approved the plans of W. McIntosh, of Abbeville, for the proposed water works.

**Annapolis, Md.*—The contract for constructing a reservoir at Naval Academy (bids opened Oct. 11) has been awarded to Noel Constr. Co., of Baltimore, for about $21,000.

Lawrence, Mass.—This city will extend high pressure service early in 1906. About 3,000 ft. of 12-in. c. i. pipe will be required. M. F. Collins, Supt. Water Wks.

Jackson, Miss.—The City Council is stated to have on Nov. 7 adopted an ordinance ordering a $250,000 bond issue for water works.

Kansas City, Mo.—The following are reported to be the bids opened on Nov. 8 by the Bd. of Pub. Wks. for the installation of a 25,000,000-gal. centrifugal water pumping engine in Quindaro station: H. N. Strait Mfg. Co., Kansas City, $14,400; Allis-Chalmers Co., Milwaukee, Wis., $16,995, and Bates Machine Co., $15,885.

Consulting Engr. Geo. H. Benzenberg, of Milwaukee, Wis., is reported to be in favor of installing a large intake into the river at Quindaro station.

North Platte, Neb.—Bids were opened on Nov. 8, at the office of the U. S. Reclamation Service, Denver, Colo., for the construction of about 50 miles of main canal for the irrigation of lands in North Platte Valley, Wyo. and Neb., Divisions Nos. 1 to 8, to be known as the Second Contract: Jas. O'Connor, Mitchell, Neb., bid only for Div. No. 5, $44,440, and Div. No. 6, $77,360. The Burke Constr. Co., St. Louis, Mo., bid only for Div. No. 5, $47,990; Div. 6, $79,640, and Div. 7, $76,240. W. F. Callahan & Son, Omaha, Neb., bid only for Div. No. 7, $99,395, and Div. No. 8, $50,835. The other three bidders submitted figures on all divisions as follows: (*a*) Deadwood Constr. Co., Deadwood, S. D., (*b*) Robinson & Maney, St. Louis, Mo.; (*c*) Kirkpatrick Bros. & Collins, Beatrice, Neb.:

	a	*b*	*c*
Division No. 1.			
Grading.			
370,000 cu. yds., Class 1	$.1398	$.15	$.195
1,000 cu. yds., Class 2..	.55	.60	.64
100 cu. yds., Class 3...	.45	.65	1.00
100 cu. yds., Class 4...	.50	.75	1.50
60,000 cu. yds. overhaul	.015	.015	.015
Total	$53,271	$57,140	$73,940
Division No. 2.			
Grading			
400,000 cu. yds., Class 1	$.13	$.15	$.185
1,000 cu. yds., Class 2..	.50	.60	.64
100 cu. yds., Class 3....	.45	.65	1.00
100 cu. yds., Class 4....	.50	.75	1.50
120,000 cu. yds. overhaul	.015	.015	.015
Total	$54,395	$62,540	$76,690
Division No. 3.			
Grading.			
380,000 cu. yds., Class 1	$.145	$.15	$.18
24,000 cu. yds., Class 2..	.55	.60	.64
100 cu. yds., Class 3....	.45	.65	1.00
100 cu. yds., Class 4....	.50	.75	1.50
80,000 cu. yds. overhaul	.015	.015	.015
Total	$69,595	$72,740	$85,210
Division No. 4.			
Grading.			
330,000 cu. yds., Class 1	$.13	$.15	$.1825
1,000 cu. yds., Class 2..	.55	.60	.64
100 cu. yds., Class 3....	.45	.65	1.00
100 cu. yds., Class 4...	.50	.75	1.50
140,000 cu. yds. overhaul	.015	.015	.015
Total	$45,645	$52,340	$63,215
Division No. 5.			
Grading.			
300,000 cu. yds., Class 1	$.13	$.15	$.185
1,000 cu. yds., Class 2..	.55	.60	.64
100 cu. yds., Class 3....	.45	.65	1.00
100 cu. yds., Class 4....	.50	.75	1.50
160,000 cu. yds. overhaul	.015	.015	.015
Total	$42,045	$48,140	$58,790
Division No. 6.			
Grading.			
340,000 cu. yds., Class 1	$.15	$.15	$.19
60,000 cu. yds., Class 2	.55	.60	.64
100 cu. yds., Class 3....	.45	.65	1.00
100 cu. yds., Class 4....	1.00	.75	1.50
100,000 cu. yds. overhaul	.015	.015	.015
Total	$85,645	$88,640	$104,750
Division No. 7.			
Grading.			
380,000 cu. yds., Class 1	$.16	$.18	$.18
30,000 cu. yds., Class 2	.60	.60	.64
100 cu. yds., Class 3....	.45	.65	1.00
100 cu. yds., Class 4....	1.00	.75	1.50
120,000 cu. yds. overhaul	.015	.015	.015
Total	$80,745	$88,340	$89,650
Division No. 8.			
Grading.			
240,000 cu. yds., Class 1	$.135	$.15	$.1825
20,000 cu. yds., Class 2	.55	.60	.64
100 cu. yds., Class 3...	.45	.65	1.00
100 cu. yds., Class 4....	.55	.75	1.50
60,000 cu. yds. overhaul	.015	.015	.015
Total	$44,400	$49,040	$57,750
Grand total	$475,741	$518,920	$609,995

Franklin, Neb.—The Council is reported to be considering the question of constructing water works.

Newark, N. J.—Morris R. Sherrerd, Ch. Engr. and City Surveyor, is reported to have reported to the Water Com. of the Bd. of Wks. on Nov. 9, that the cost of extending the high-pressure water system next year, along Broad St. bet. Central Ave. and State St. and along McWhorter St., would cost about $50,000.

Asbury Park, N. J.—Bids will be received until Nov. 27 by John L. Coffin, Supt. Dept. Water and Sewers, for furnishing and erecting a 200-h.p. internal furnace tubular boiler, as advertised in The Engineering Record.

New York, N. Y.—Bids will be received until Nov. 29 by John T. Oakley, Comr., Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains in numerous streets, Boros. Manhattan and Bronx.

Watertown, N. Y.—The question of constructing a new reservoir is reported under consideration here.

**Constableville, N. Y.*—John J. Siegrist, of Utica, is stated to have secured the contract for constructing water works, for about $17,000.

Rochester, N. Y.—M. W. Kellogg & Co., of N. Y. City, are reported to be the lowest bidders for furnishing material and building a 250-ft. brick chimney at the pumping station for $18,543.

Brooklyn, N. Y.—The following are the bids opened Nov. 8 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, delivering, erecting and connecting 4 water tube boilers at the new Ridgewood pumping station: R. J. Gerstle, 347 E. 44th St., N. Y. City, $29,297; Heine Safety Boiler Co., 11 Bway., N. Y. City, $28,800; Frank McSwegan, corner Dover St. and Franklin Sq., N. Y. City, $31,900; Babcock & Wilcox Co., 85 Liberty St., N. Y. City, $31,750, and Sturley Consolidated Boiler Co., $29,500.

Auburn, N. Y.—Bids will be received by the Water Board until Dec. 6 for furnishing 1,500 lin. ft. 36-in. wrought iron intake pipe, with about 14 flexible or ball and socket joints attached thereto, as advertised in The Engineering Record.

Bismarck, N. D.—Bids will be received until Nov. 27 by W. W. Robinson, Jr., Ch. Q. M., U. S. A., St. Paul, Minn., for an 8-in. water main, running from 9th and Rosser Sts., Bismarck, to and connecting with present water main at Ft. Lincoln, with valves, meter, etc.

Cleveland, O.—Bids will be received until Nov. 25 by the Bd. Pub. Service (A. R. Callow, Secy.) for furnishing and delivering nine 3-in., nine 4-in. and two 6-in. water meters.

McKeesport, Pa.—C. E. Soles, City Controller, writes that the citizens voted Nov. 7 to issue $150,000 bonds for the construction of a filtration plant, settling tanks, etc.

**Philadelphia, Pa.*—The Coatesville Iron Co. is reported to have secured the contract for the installation of 10 additional boilers at the Belmont pumping station (bids opened Nov. 3) for $38,800.

Georgetown, S. C.—The Black River Water Co. is reported incorporated, with a capital of $150,000 by E. L. Lloyd, R. M. Barnes, W. D. Morgan and others.

**Belle Fourche, S. D.*—Raymond F. Walter, of Belle Fourche, Engr. U. S. Reclamation Service, writes that Orman & Crook, of Pueblo, Colo., secured the contract for all three schedules in connection with the construction of dam, canals, etc. (bids opened Oct. 26) for a total of $1,003,000. For detail list of bids received for this work, see issue of The Engineering Record, Nov. 4.

Midlothian, Tex.—See "Power Plants, Gas and Electricity."

Whitesboro, Tex.—M. P. Kelly, of Gainesville, is reported to have secured a franchise for water works in Whitesboro.

Norfolk, Va.—The Water Com. has decided to recommend to City Council the appointment of a commission to look after an additional water supply for the future. The commission will include T. S. Southgate, Chmn. Fin. Com.; E. B. Freeman, Chmn. Water Bd.; W. T. Brocke, City Engr.

Centralia, Wash.—It is reported that the Centralia Water Co. (Harvey J. Johnson, Pres.) will probably make improvements, to include new wells, a filtration system, new pumps and the enlarging of the reservoir.

Prescott, Wash.—The citizens are reported to have voted to construct water works at a cost of $5,500.

Milwaukee, Wis.—It is stated that it has been decided to construct a tunnel 6½ x 7 ft. under the river from the foot of Knapp St. to Poplar St. The question of installing a new triple expansion pumping engine at the North Point pumping station is also reported under consideration.

Dalhousie, N. B.—It is reported that Willis Chipman, of Toronto, Ont., will prepare plans for water works for Dalhousie.

Vancouver, B. C.—It is stated that bids will be received until Dec. 13 by A. McEvoy, City Clk., for supplying brass goods, lead pipe and galvanized pipe and fittings for water works dept.

Parral, Mex.—Governor Creel, of Chihuahua, is reported to have introduced in Legislature a bill to allow the City of Parral, to issue $300,000 bonds to be used for the construction of water works and a sewerage system. The work as contemplated, will, it is said, cost $350,000, the remaining $50,000 will be furnished by the State and the municipality of Parral. Plans have been prepared by Nelson Rhodes, Jr., of Chihuahua.

SEWERAGE ND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Oxnard, Cal.—C. J. Elliott, City Clk., writes that bids will be received until 8 P. M., Nov. 28, for the construction of a sewerage system, to cost about $50,000. Engineer, F. H. Olmsted, Los Angeles.

Washington, D. C.—Gen. Mackenzie, Ch. of Engrs., in his annual report, submitted an estimate of $10,000 for preliminary surveys for an additional conduit from Great Falls.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Apalachicola, Fla.—See "Water."

Nampa, Idaho.—See "Water."

**Boise, Idaho.*—The folowing are the bids opened on Nov. 9 by the Mayor and Common Council for constructing sewers in Lateral Sewer Districts Nos. 101 and 102: (*a*) Jas. Kennedy, Fargo, N. D., $27,222 (awarded contract); (*b*) L. H. Gorick, Seattle, Wash., $27,846; (*c*) Munn & Co., Nebraska City, Neb., $30,457; (*d*) Jas. Frainey, Portland, Ore., $31,511; (*e*) T. Ryan, Seattle, Wash., $31,984; (*f*) Hanley & Ritchie, Topeka, Kan., $32,608; (*g*) J. P. O'Neil, Ogden, Utah, $33,913; (*h*) C. C. Stevenson, Boise, $34,569; (*i*) Clement & Strange, Salt Lake City, Utah, $36,212; (*j*) Showell Bros. & Belcher, Blackfoot, $38,995; (*k*) Wheelwright Constr. Co., Ogden, Utah, $39,789; (*l*) Idaho Hdw. & Plumbing Co., Boise, $43,009; (*m*) Liberty Plumbing & Heating Co., Boise, $43,642; (*n*) Carlson-Lusk Hardware Co., Boise, $44,382.

	26,337 lin. ft. 8-in. pipe laid.	1,600 lin. ft. 10-in. pipe laid.	1,500 8x6-in. Y's.	150 10x6-in. Y's.	107 Man-holes.	1,400 lin. ft. flush line 4-in. wood stave.
**a*	$0.72	$0.86	$0.69	$0.70	$42.00	$0.40
b	.73	.85	.75	1.00	45.00	.30
c	.78	1.06	1.00	1.25	47.50	.32
d	.70	.80	2.25	2.50	45.00	.70
e	.81	.99	.60	1.00	45.00	.43
f	.78	1.02	2.00	2.00	43.00	.38
g	.90	1.05	1.20	1.50	45.00	.35
h	.95	1.05	.70	.90	52.00	.32
i	.93	1.15	1.20	1.00	57.00	.45
j	1.05	1.37½	1.50	2.00	43.00	.35
k	.80	.94	3.70	4.25	43.00	.50
l	.92	1.10	3.90	4.50	56.00	.43
m	.89	1.09	4.00	4.50	58.00	.75
n	95	1.07	3.95	4.60	60.00	.47½

**Clinton, Ia.*—Chas. P. Chase, City Engr., writes that the following are the bids opened on Oct. 25 by the City Council for the construction of sewers in Dist. No. 4: (*a*) Daley & Brown, Jacksonville, Ill.; (*b*) Greene & Sons Co., Appleton, Wis.; (*c*) M. Ford, Cedar Rapids; (*d*) Chas. M. Porter, Chicago, Ill.; (*e*) Peoples' Constr. Co., Davenport (awarded contract). (The price of sewers given per ft. includes earth excav.):

	a	*b*	*c*	*d*	**e*
Steel and Concrete Sewers—					
1,700 ft. 6 ft. 3 in. x 10 ft. (earth section)	$13.21	$15.20	$14.53	$11.30	$11.50
380 ft. 6 ft. 3 in. x 10 ft. (rock section)	7.42	9.05	16.37	11.25	8.50
1,360 ft. 6 ft. 3 in. x 9 ft. (rock section)	6.60	7.00	13.30	10.00	7.55
372 ft. 5 ft. 9 in. x 8 ft. (rock section)	6.40	6.61	10.15	8.60	7.50
500 ft. 5 ft. 9 in. x 8 ft. (earth section)	7.17	10.00	8.57	10.15	7.85
1,040 ft. 66-in. circulars	4.72	5.00	6.90	6.30	4.50
Plain Concrete Sewers—					
400 ft. 5 ft. 3 in. x 7 ft. (rock sections)	4.20	6.45	6.67	7.65	4.95
400 ft. 5 ft. 3 in. x 7 ft. (earth section)	4.95	6.45	7.82	8.20	5.60
600 ft. 5 ft. 3 in. x 6 ft. (earth section)	4.95	6.80	7.82	7.50	5.35
200 ft. 5 ft. 3 in. x 6 ft. (rock section)	4.10	6.80	7.82	6.60	4.45
510 ft. 4 ft. 6 in. x 5 ft. 6 in. (rock section)	3.42	5.40	7.48	6.10	4.10
300 ft. 4 ft. 6 in. x 5 ft. 6 in. (earth section)	4.30	5.40	7.48	6.85	4.70
810 ft. 4 ft. 3 in. x 5 ft. (rock section)	3.12	4.65	4.48	6.25	3.52
376 ft. 60-in. circular	3.20	4.05	8.33	5.10	3.65
376 ft. 57-in. circular	2.80	4.05	6.96	5.10	3.25
376 ft. 51-in. circular	2.63	1.90	4.83	4.35	2.80
786 ft. 42-in.	2.40	2.43	3.91	4.10	2.60
1,050 ft. 40-in. (rock section)	2.20	4.60	5.86	4.10	2.80
340 ft. 40-in. (earth section)	2.80	5.25	4.88	4.10	2.80
Brick Sewers—					
800 ft. 48-in. circular (2 ring)	4.00	5.00	5.75	6.25	4.60
480 ft. 40-in. (2 ring)	3.65	4.70	3.11	5.50	3.85
400 ft. 42-in. (1 ring)	2.70	2.42	4.88	4.10	3.30
1,200 ft. 30 x 45-in. (1 ring)	2.48	2.42	4.20	3.20	3.15
800 ft. 26 x 39-in. (1 ring)	2.40	2.20	3.39	2.90	3.00
400 ft. 28 x 42-in. (1 ring)	2.40	2.00	4.54	3.00	2.75
410 ft. 22 x 33-in. (1 ring)	2.20	1.75	3.16	2.65	2.50
Vitrified Pipe—					
1,417 ft. 36-in.	3.95	5.10	4.46	4.50	4.30
2,077 ft. 30-in.	3.52	3.80	3.45	3.10	3.60
1,321 ft. 24-in.	1.80	2.10	3.05	2.10	2.10
820 ft. 22-in.	1.70	1.80	2.87	1.90	2.10
1,871 ft. 18-in.	1.10	1.20	1.84	1.50	1.40
200 ft. 12-in.	.80	.60	1.43	.90	1.00
153 catch basins complete	46.00	26.50	25.00	30.00	32.00
3,978 ft. 10-in. catch basin connecting pipe	.40	.50	.75	.50	.85
48 manholes complete	36.00	26.00	30.00	30.00	38.00
Protection bulkhead complete	1,350.00	1,300.00	1,500.00	1,200.00	1,350.00
2,500 sq. yds. rip-rap	1.10	1.00	.90	.25	1.00
Extra concrete under railways, per cu. yd.	22.00	8.00	..	8.00	..
18,600 cu. yds, rock excav.	3.25	2.25	.26	1.50	1.15
23,872 ft. 8-in. vitr. drain tile	.18	.20	.25	.20	1.20
Total	$177,424	$175,339	$169,744	$169,020	$168,724

**Items marked thus give the names of parties awarded contracts.*

Tampa, Fla.—It is reported that bids will be received until Nov. 21 by the Bd. Pub. Wks. (S. L. Biglow, Clk.) for constructing brick and terra cotta pipe sewers. Approximate estimate of quantities: 550,000 hard-burned No. 1 Florida brick; 600 bbls. Portland cement; 26,000 ft. B. M., 2 ft. x 8 ft. x 8½ ft. foundation plank; 38 catch basin covers and 19 manhole covers.

Chicago, Ill.—Bids will be received by the Bd. of Local Improv. (C. D. Hill, Engr.) until Dec. 6 for constructing the 95th St. intercepting sewer; probable cost of work, $800,000.

Chicago, Ill.—Bids will be received by the Bd. Local Improv. (John A. May, Secy.) until Nov. 21 for constructing vitr. tile pipe sewers, with manholes and catch-basins, in portions of Aves. J. and N., Ewings and Jeffrey Aves.

Bloomington, Ill.—Bids are wanted Nov. 24 for pipe sewers on Olive and Leland Sts. Elmer Folsom, City Engr.

Washington, Ia.—Bertha Curran, Acting City Clk., writes that bids will be received until Dec. 4 for extending the trunk sewer; probable cost, $10,000. Engineer, D. C. Kyle, of Washington.

Des Moines, Ia.—Bids will be received until Nov. 25 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for constructing about 775 lin. ft. 12-in. vitr. clay pipe sewer in Madison Ave.

Independence, Kan.—Bids will be received by T. N. Sickles, City Clk., until Dec. 19, for constructing the R. R. general sewer, 575 ft. 10-in. pipe and 1,825 ft. 18-in. pipe, and the Washington St. lateral sewer, 900 ft. 10-in. sewer pipe, as advertised in The Engineering Record.

Lawton, Okla. Ter.—Judge F. E. Gillette is reported to have granted a permanent injunction against the construction of the proposed storm water sewer, for which J. O. Sevens, of Guthrie, recently secured the contract at a cost of $38,000.

McKees Rocks, Pa.—It is stated that bids will be received until Nov. 27 by R. J. Maconbray, Clk., Stowe Township, 2 Frazier Ave., McKees Rocks, for constructing 1,280 ft. 36-in. brick or D. S. terra cotta pipe sewer; 3,000 ft. 12-in. terra cotta pipe sewer; 1,110 ft. 24-in. D. S. terra cotta pipe sewer; 9 manholes, etc. S. L. Gardner, Township Engr., McKees Rocks.

Exeter, Pa.—The citizens are reported to have voted to issue $20,000 bonds for the construction of a sewerage system.

Bristol, Pa.—Bids will be received until Dec. 20 for the construction of a separate system of sewerage and sewage disposal plant, as advertised in The Engineering Record.

**Reading, Pa.*—At a meeting of City Council, Nov. 13, it was decided to award the contract for increasing the capacity of the sewage disposal plant at Millmont to O. M. Weand, of Reading; his bid for the plant complete is $73,000.

San Antonio, Tex.—See "Paving and Roadmaking."

**Ft. Worth, Tex.*—Press reports state that the City Council on Nov. 8 awarded the contract for the construction of the sewerage system in the 5th, 6th, 7th, 8th and part of the 2d Ward, to the McQuatters Plumbing & Machine Co., of Hillsboro, and W. W. Cook & Sons, of Junction City, Kan. The approximate cost is about $72,000. The new sewers will be about 30 miles in length.

**Chattanooga, Tenn.*—Robt. Hooke, City Engr., writes that bids were opened by the Bd. of Pub. Wks., Nov. 7, for the construction of brick and pipe sewers and appurtenances in Sewer Dist. Nos. 8, 4. 6 and 10. The following are the totals of bids received for all the districts, also detail bids for sewers in Sewer Dist. No. 8 : (*a*) Noll & Thompson, Chattanooga, $73,654; (*b*) E. T. Lewis & Co., Nashville, $167,560; (*c*) Guild & Co., Chattanooga, $74,704 (awarded contract); (*d*) Robt. C. Storrie, New Orleans, La., $99,560.

	a	*b*	**c*	*d*
3,664 cu. yds. earth excav. under 20 ft.	$0.47	$0.75	$0.75	$1.30
9,771 cu. yds. earth excav., 20 to 40 ft. deep	.78	2.00	.85	1.40
10,261 cu. yds. earth excav., 40 to 61 ft. deep	.99	4.00	.95	1.30
189 cu. yds. rock excav., open trench	3.00	6.00	3.00	4.00
100 cu. yds. earth excav., in tunnel	1.75	20.60	3.35	10.00
28 cu. yds. rock excav., in tunnel	3.50	28.00	5.00	10.00
1,268 ft. 50 x 75-in. sewer (2 rings)	6.32	5.00	5.70	6.50
461 ft. 50 x 75-in. sewer (3 rings)	10.05	7.00	8.25	10.00
80 ft. 50 x 75-in. sewer (3 rings), in tunnel	16.76½	12.00	14.00	15.00
429 ft. 48 x 72-in. sewer (2 rings)	5.72½	4.50	5.40	6.00
357 ft. 48 x 72-in. sewer (3 rings)	8.93	...	8.00	9.00
676 ft. 46 x 69-in. sewer (2 rings)	5.35	4.00	5.35	5.50
11 manholes	134.80 to 597.19	12.00 to 75.00	61.00 to 320.00	10.00 to 420.00
85 cu. yds. excav. for sewage diverter	5.00	2.50	1.30	1.50
44 cu. yds. concrete walls and piers	8.50	15.00	9.00	12.00
10 sq. yds. cement top	.50	3.00	.90	1.00
4 tons 16-in. c.-i. pipe	40.00	.03½	60.00	150.00
1 drop manhole, Blackford & Hampton	243.00	100.00	430.00	625.00
1 drop manhole, Blackford & Wiehl	243.00	100.00	375.00	575.00
22 ft. 24-in. cir. brick sewer (3 rings)	4.05	8.00	6.40	10.00
34 ft. 24-in. pipe, East End Ave.	6.85	4.00	8.00	10.00
3 cu. yds. concrete fill around pipe	24.00	25.00	10.00	12.00
Pipe Sewers—				
1,336 ft. 12-in., 6 to 8 ft.	.62½	2.10	.87	.95
184 ft. 12-in., 8 to 10 ft.	.71	2.25	.95	1.10
335 ft. 15-in., 6 to 8 ft.	.80	2.00	.90	1.20
288 ft. 15-in., 8 to 10 ft.	.86	2.50	1.10	1.35
470 ft. 18-in., 6 to 8 ft.	1.08	2.30	1.40	1.60
666 ft. 18-in., 8 to 10 ft.	1.20	2.70	1.55	1.75
334 ft. 20-in., 6 to 8 ft.	1.24	2.60	1.75	1.85
1,622 ft. 20-in., 8 to 10 ft.	1.35	3.50	2.00	2.05
130 ft. 20-in., 10 to 12 ft.	1.68	4.00	2.10	2.25
110 ft. 20-in., 12 to 14 ft.	1.79	4.40	2.30	2.45
5 junction manholes 8 ft.	70.07	20.00	48.00	60.00
8 junction manholes, 10 ft.	82.94	28.00	55.00	70.00
2 junction manholes 12 ft.	95.00	30.00	65.00	80.00
For each additional foot in height of manhole	7.42	20.00	5.35	6.00
10 cu. yds. rock excav., pipe trenches	2.25	25.00	3.00	5.00

Horton, Kan.—B. Norris, City Clk., writes that there is talk of constructing a sewerage system, but nothing will be done before spring.

Salem, Mass.—Bids will be received until Nov. 27 by the Sewerage Comrs. (Jos. N. Petersen, Chmn.) for furnishing and installing a sewage pumping plant; also for furnishing approximately 108 lin. ft. 36-in. pipe, 3 sleeves 30-in., 1⅛ curve 30-in., two 1-32 curve 30-in., and one special casting 30-in.

Crystal Falls, Mich.—Robt. Munns, City Clk., writes that the contract for constructing the proposed sewerage system will probable not be let before spring. Cost about $16,000. Engineer, E. G. Bradbury, Columbus, O.

Moorhead, Minn.—H. E. Roberts, City Clk., writes that no bids were received on Oct. 27 for the construction of the main outfall sewer. New bids will probably be received in the spring.

**St. Charles, Mo.*—Chas. H. Kansteimer, City Clk., writes that the Wm. Burke Plumbing Co. has secured the contract for constructing 1,900 ft. 10-in. sewer (bids opened Nov. 9) for $1,250. This sewer is intended to be incorporated in a general system of sewers, about 15 miles in length, which this city contemplates constructing early next spring. Engineers, Burns & McDonnell, Kansas City.

Newark, N. J.—Edw. S. Rankin, Engr. Street and Water Comrs., Sewer Dept., estimates the cost of constructing a sewer on S. 12th St., bet. S. Orange and 16th Aves., at $20,000.

**Plainfield, N. J.*—Andrew Gavett, City Surveyor, writes that Stacy B. Opdyke, Jr., 1931 Bway., New York, N. Y., has secured the contract for constructing 568 ft. 36 x 48-in. concrete sewer at $5.22 per ft.; total cost, $3,662.

Norwood, O.—Bids will be received until Dec. 2 by the Bd. Pub. Service (J. E. Thorpe, Clk.) for furnishing material and constructing 24-in. pipe storm water sewer in a portion of Lincoln Ave.

St. Marys, O.—F. Aschbacker, City Aud., writes that the citizens have voted to issue $75,000 bonds for the construction of a sewerage system. Bids will probably be called for in the spring. Engineer, F. C. Keuthan.

North Yakima, Wash.—Bids will be received by J. C. Brooker, City Clk., until Nov. 20 for $48,000 main trunk sewer bonds.

**North Yakima, Wash.*—Patk. Mullen, of North Yakima, is reported to have secured the contract for constructing sewers (bids opened Nov. 6) for $40,204. The work comprises 2,350 lin. ft. 16-in. wood stave pipe; 62 manholes and of vitrified pipe, 2,350 ft. 18-in., 2,700 lin. ft. 15-in., 9,415 ft. 12-in. and 7,915 ft. 10-in.

Mt. Vernon, Wash.—A petition is reported to have been presented to Town Council, looking to the construction of a sewerage system.

BRIDGES.

Notes Arranged Alphabetically by States.

**San Francisco, Col.*—The contract for widening the steel bridge at San Jose and Mt. Vernon Ave. is reported to have been awarded (bids opened Oct. 28) to Healy, Tibbitts & Co., 22 Market St., for $11,015.

Monte Vista, Colo.—T. W. Jaycox, State Engr., Denver, writes that bids opened Nov. 6 for the construction of a combination bridge, 150-ft. span, across Rio Grande River, near Monte Vista, have been rejected, as all bids submitted exceeded appropriation. New bids will be received as soon as new plans are prepared.

Atlanta, Ga.—M. T. Edgerton, of Atlanta, Secy. Atlanta & Carolina Ry. Co., writes that it is proposed to construct 2 bridges at a cost of $20,000. M. Mason, Ch. Engr., Prudential Bldg.

**South Bend, Ind.*—The Lafayette Eng. Co., of Lafayette, has secured the contract for constructing the substructure and superstructure of a bridge over St. Joseph River (bids opened Nov. 8 by the Co. Comrs.) for $18,924.

Lexington, Ky.—The Citizens are stated to have voted to issue $27,000 bonds for the construction of a viaduct over the railroad tracks at Ayers Alley.

Owensboro, Ky.—N. Lang, City Clk., writes that a survey will soon be commenced for the construction of the proposed bridge over Ohio River. E. B. Shifley, City Engr.

New Orleans, La.—The Finance Com. is reported to have reported favorably on the bid of J. A. Craven & Co., for the construction and repair of fenders at bridges over New and Old Basins, for $12,759.

**Boston, Mass.*—The following are the bids opened on Nov. 9 by Wm. Jackson, City Engr., for constructing the draw pier of Atlantic Ave. bridge: Lawler Bros., 16 City Sq., Charlestown, Mass., $6,035 (awarded contract); Wm. L. Miller, 19 Milk St., $6,625; W. H. Ellis, 17 Milk St., $7,100; Cahill Constr. Co., 7 Water St., $7,387; Geo. Hayes, 166 Devonshire St., $7,600; George H. Cavanagh, 166 Devonshire St., $7,674.

Cadillac, Mich.—A. E. Wilson is stated to have submitted the lowest bid for constructing the boulevard bridge, the bid being $5,465.

Kansas City, Mo.—W. B. Storey, Jr., of Topeka, Kan., Ch. Engr., Santa Fe Ry., will have charge of the construction of a viaduct for the Kansas City Belt Ry. Co., over Bway., at Kansas City. A preliminary sketch has been presented to E. A. Harper, City Engr.

**Jefferson City, Mo.*—The County Clerk writes that the contract for constructing a steel bridge, four miles from Jefferson (bids opened Nov. 9) has been awarded to The Canton Bridge Co., Canton, O., for $3,683.

Scarsdale, N. Y.—See "Railroads."

New York, N. Y.—An ordinance has been passed providing for the issue of $500,000 corporate stock for constructing and improving Manhattan Terminal of Williamsburg Bridge.

Long Island City, L. I., N. Y.—The Bd. of Aldermen passed an ordinance providing for the issue of $175,000 corporate stock for constructing a bridge over Dutch Kills Creek on the line of Borden Ave.

Tiffin, O.—The Comrs. of Seneca County have decided to construct a bridge over Sandusky River, a 200-ft. span, 7 miles south of Tiffin.

**Marion, O.*—The contract for constructing the steel bridge over Scioto River, to be known as Newmans Bridge, is reported to have been awarded to the Marion Bridge Wks., the bids submitted ranging from $4,953 to $6,900.

Harrisburg, Pa.—The citizens voted Nov. 7 to issue $200,000 bonds for constructing Mulberry St. overhead bridge. M. B. Cowden, City Engr.

**Welcome, Wash.*—J. A. Miller, County Aud., Bellingham, writes that the Puget South Bridge & Dredging Co., of Seattle, has secured the contract for constructing a steel combination bridge, 165-ft. span, across Moosack River, at Welcome, for $6,140.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Bids will be received by the Bd. of Pub. Wks. (J. N. Hazlehurst, Ch. Engr.) until Nov. 23 for 4,000 sq. yds. resurfacing work.

San Francisco, Cal.—The Works Bd. is reported to have under consideration the repaving of a portion of Turk St. and grading a portion of Vallejo St.

**Stockton, Cal.*—C. C. House is stated to have received the contract for improving several streets in Stockton, for $39,410.

**Bloomington, Ill.*—The Barber Asphalt Paving Co., of Chicago, has secured the contract for paving Main St., with asphalt, 11,335 sq. yds., at $1.24 per sq. yd., to be 1½ in. thick, on old brick pavement.

**Peoria, Ill.*—The contract for resurfacing with brick a portion of Hamilton St. is reported to have been awarded to Jas. S. Allen, 1723 Main St., for $4,807. The City Engineer is reported to have estimated the cost of paving as follows: Portion of Wisconsin Ave. with brick, $16,018; portion of Spencer St. with brick, $25,868, and Persimmon St., $13,389.

**Centralia, Ill.*—Case & Evans, of Bloomington, are stated to have received the contract for brick paving in Centralia, for $174,869.

Chicago, Ill.—C. D. Hill, Engr. of the Bd. of Local Improvements, is stated to have estimated the cost of building the boulevard link on Michigan Ave. at $5,402,795. This will include the erection of the necessary bridges, retaining wall and the filling in, curbing and paving necessary, in the improvement.

**East St. Louis, Ill.*—McCabe & Co., of East St. Louis, has secured the contract for paving St. Clair Ave., from 1st St. to the easterly right of way line of the East St. Louis & C. Ry., for $8,045, using Wabash brick. He bid for 3,340 sq. yds. brick paving, $1.50; 1,600 lin. ft. limestone curb, 50 cts.; 665 lin. ft. 18-in. pipe laid, 90 cts., and 965 ft. 15-in. pipe, 73 cts

**Salem, Ind.*—F. E. Morris, Co. Aud., writes that the contract for constructing a gravel road in Gibson Township (bids opened Nov. 6) has been awarded to Elwood Johnson, of Orleans, for $3,099.

Muncie, Ind.—About 7 miles of pavement is proposed. Material to be used not yet decided upon. John O. Potter, City Engr.

Brownstown, Ind.—Bids will be received until Dec. 5 by the Bd. Co. Comrs., for constructing about 1¾ miles of the extension of the Goss Mill and Mt. Zion Road, Owen Township. H. W. Wacker, Co. Aud.

Union, Ind.—Bids will be received until Dec. 4 by the Bd. Co. Comrs. (Jos. Firsich, Chmn.) for constructing a public highway in Ray Township. Chas. A. Miller, Co. Aud.

Des Moines, Ia.—Bids will be received about Nov. 23 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for paving about 1,333 sq. yds. of W. 28th St., the paving to consist of a 6-in. base of cinders, covered with 6 inches of concrete, composed of three parts broken tile and two parts gravel and sand and part Portland cement.

**Items marked thus give the names of parties awarded contracts.*

Topeka, Kan.—The folowing bids are stated to have been opened Nov. 6 by the City Council for paving Kansas Ave.: John Bradley, with California sheet asphalt (2 bids), 84 cts. and $1; R. T. Conway, with California asphalt, $1.03; Hanley & Ritchie, with brick, $1.23; Haskins & Ramsey, with brick, $1.25; Barber Asphalt Paving Co., with bituminous macadam (2 bids) $1.28 and $1.33, with sheet asphalt (4 bids) $1.23 to $1.43; Kansas Bithulithic Co., with bitulithic (2 bids), $1.63 and $1.74.

New Orleans, La.—The Barber Asphalt Paving Co., Hennen Bldg., is reported to have submitted the only bid received for repaving with asphalt on a portion of Burgundy St., the bid being 67 cts. per cu. ft. for asphalt, 43 cts. per cu. ft. for binder, 19½ cts. per cu. ft. for concrete.

City Engineer Hardee is stated to have submitted a report to the Finance Com. on a municipal asphalt plant. He estimates the cost of constructing and equiping the plant at $31,690.

Kalamazoo, Mich.—It is stated that City Council adopted a resolution authorizing the City Clk to receive bids until about Dec. 18, for paving Rose St.

**St. Paul, Minn.*—The contract for macadamizing a portion of Maria Ave. is reported to have been awarded to J. M. Thornton for $5,843. Bids opened Nov. 2.

Ft. Snelling, Minn.—Bids will be received until Nov. 22 by Capt. Amos W. Kimball, Q. M., U. S. A., St. Paul, Minn., for repairs and constructing cement sidewalks, curbings and crossings at Ft. Snelling.

Newark, N. J.—The Common Council is stated to have reported favorably on appropriating $7,300 for repairs to asphalt streets.

**Kearney, N. J.*—John Doriety is reported to have secured the contract for grading, curbing and flagging of Devon St., for $10,325.

Atlantic City, N. J.—The following bids are reported to have been opened on Nov. 13 for paving Atlantic Ave., requiring 93,000 sq. yds. Trinidad Lake asphalt, 12,000 sq. yds. vitrified fire clay block, 47,000 cu. yds. excavation, 29,300 lin. ft. straight Balfour N. C. granite curb: Barber Asphalt Paving Co., $259,347; Cleveland Trinidad Asphalt Paving Co., $259,310; Walter Quinlan Co., $259,400.

Jersey City, N. J.—Bids will be received until Nov. 20 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) for improving 16th St., requiring about 2,460 sq. yds. Belgian block; also Milton Ave., requiring about 735 sq. yds. Belgian block.

**New York, N. Y.*—The following are the bids opened on Nov. 9 by the Comrs. of Parks, for constructing sidewalks, etc., in Cathedral Parkway, bet. 7th and 5th Aves., and in the Plaza at 110th St. and 5th Ave., Manhattan Boro.: (*a*) Sicilian Asphalt Paving Co., 41 Park Row, $14,435 (awarded contract); (*b*) Vulcanite Paving Co., 114 Liberty St., $16,562:

	**a*	*b*
36,500 sq. ft. walk pavt., of rock asphalt mastic, with concrete base and rubble stone foundations	$.24	$.29½
12,000 sq. ft. walk pavt. of Portland cement mortar with concrete base	.15	.16
1,550 cu. yds. mold to furnish and deposit in tree plots	2.50	2.50

Buffalo, N. Y.—The Barber Asphalt Paving Co. is stated to have submitted the lowest bids on Nov. 3 for paving with asphalt portions of Alabama and Scott Sts., the bid on the former was $2,266 and the latter $2,828.

The German Rock Cement & Asphalt Co. is reported to have submitted the lowest bid on paving Lord St., their bid being $12,770.

**Cincinnati, O.*—The contract for paving with bitulithic on Celestial St., 5,000 sq. yds. (bids opened Nov. 6) has been awarded to Warren Bros. Co., of Cincinnati, for $17,257.

Cincinnati, O.—Bids will be received until Dec. 4 by the Bd. Pub. Service (Geo. T. Holmes, Clk.) for furnishing material and improving a portion of Academy Ave., by grading, curbing and paving with brick; also Purcell Ave., by grading, curbing and macadamizing.

Cleveland, O.—Bids will be received until Nov. 25 by the Bd. Co. Comrs. (Julius C. Dorn, Clk.), for paving State road No. 3. Wm. H. Evers, Co. Engr., 237 The Arcade.

The folowing are the bids opened on Nov. 8 by the Bd. of Pub. Service for repaving a portion of Bway.: The Cleveland Trinidad Paving Co., $15,861; The Northern Ohio Paving & Constr. Co., $15,493; John F. Brannon, $15,961, and The Standard Paving Co., $16,544. The lowest bidder, the Northern Ohio Paving Co., bid for 5,000 sq. ft. Medina pav't. laid 35 cts.; 42,000 sq. ft. dressed block Medina pav't., relaid, 15 cts.; 3,800 sq. ft. concrete foundation, laid, 7½ cts.; 2,000 sq. ft. brick pav't., laid, 20 cts.; 8,000 sq. ft. brick pav't., relaid, 15 cts.; 2,500 lin. ft. stone curb, reset, 11 cts.

**Toledo, O.*—P. Garrigan is stated to have received the contract for paving with Metropolitan block a portion of Genesee St., for about $8,699.

Harrisburg, Pa.—The citizens voted Nov. 7 to issue $100,000 bonds for street improvements. M. B. Cowden, City Engr.

**New Brighton, Pa.*—The contract for paving 9th St. is reported to have been awarded to J. G. Maguire & Co., at $4,100.

Steelton, Pa.—The following bids are reported to have been opened Nov. 1 for paving 31,500 sq. yds. on Front St.; Sawders Paving & Constr. Co., with brick (3 bids), $81,772 to $88,563; Geo. B. Stucker, of Harrisburg, with brick (2 bids), $79,781 and $84,997; Central Constr. & Supply Co., with brick (3 bids), $80,850 to $85,785; Barber Asphalt Paving Co., with asphaltum (2 bids), $74,449 and $81,402; Russel & Jennison, with wood block (3 bids), $104,743 to $106,012; Lee MacDonald, with asphaltum (3 bids), $83,019 to $89,780, with asphalt block (2 bids) $100,705 and $107,473; West Newcomb, with brick (3 bids), $82,323 to $88,376; Filbert Paving & Constr. Co., with asphalt (3 bids), $79,498 to $81,715; Dusker Contr. Co., with brick, $88,390, and the United States Wood Preserving Co., with wooden blocks (3 bids), $114,165 to $118,395.

Greensburg, Pa.—The following bids are stated to have been opened Nov. 6 for grading, curbing and paving with vitrified brick portions of *a* Tremont St., *b* 3d St.: Greensburg Concrete Constr. & Eng. Co., *a* (2 bids) $10,395 and $10,486, *b* (2 bids) $15,150 and $15,444; W. W. Kelly, of McKeesport, *a* (2 bids) $8,380 and $8,331, *b* (2 bids) $15,410 and $15,200; Bowman Bros. of McKeesport, *a* $10,755, *b* $14,686; The Hallam Constr. Co., of Washington, *a* $9,112, *b* $14,808.

Southampton, Pa.—Bids will be received until Nov. 22 by Robt. Wright, Superv., Southampton Township, Southampton, for constructing 16,247 lin. ft. road in Southampton Township, Bucks Co.

Dandridge, Tenn.—J. T. Holt, Co. Clk., writes that the citizens voted Nov. 11 to issue $200,000 bonds for constructing pikes.

San Antonio, Tex.—District No. 11 has been formed and it is proposed to hold an election Dec. 10 to vote on issuing $120,000 bonds for improvements, to consist of the construction of storm water sewers, about 1 mile of macadam and 32,000 sq. yds. brick paving on concrete foundation. John D. Rullman, City Engr.

Sherman, Tex.—Chas. E. Hayden, City Engr., writes that all bids opened on Oct. 23 for 14,290 sq. yds. brick paving have been rejected. Date for receiving new bids not yet set.

El Paso, Tex.—Paving bonds amounting to $175,000 are reported sold.

Petersburg, Va.—G. B. Gill, City Aud., writes that it is proposed to construct granolithic sidewalks at a cost of $30,000. R. D. Budd, City Engr.

Richmond, Va.—The Common Council is stated to have passed an ordinance providing for the appropriation of $50,000 for paving Grace and Franklin Sts.

Seattle, Wash.—Asst. City Engineer Dimock is reported to have estimated the cost of paving the entire district north of Denny way and east of Queen Anne Ave., at about $200,000.

The following bids are stated to have been received for paving with brick, 10,150 sq. yds. in the King St. Dist.; Stirret & Goetz, $38,689; Barber Asphalt Paving Co., $42,313; F. McClellan, $44,163; Sparger Concrete Co., $40,237, and Bell & Price, $43,838.

Spokane, Wash.—It is stated that the Washington Water Power Co. has decided to pave a portion of Howard St., at a cost of $15,500.

Tacoma, Wash.—It is proposed to pave Jefferson St. from Pacific Ave. to South E. St., also Commerce St. from South 7th to Jefferson St., about 40,000 sq. yds. asphalt paving on a concrete foundation. Bids for the work will probably be called for in February.

Toronto, Ont.—The contract for paving Ossington Ave. with bitulithic is reported to have been awarded to the Warren Co., at $13,656.

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Abbeville, Ala.—The citizens are reported to be discussing the question of constructing an electric light plant.

Ft. Payne, Ala.—The Alabama Cooperage Co., of Ft. Payne, is reported to have petitioned Council for a franchise to construct an electric light plant to furnish light for the streets, residences and business houses.

Douglas, Ariz.—The City Clk. writes that a gas franchise has been granted to a company of which J. L. Brown is Secy.

**Los Angeles, Cal.*—The Los Angeles Gas & Electric Co. is reported to have secured the contract for lighting the city for 3 years, at $6.30 per lamp per year; total amount of contract about $500,000.

Enfield, Conn.—The Enfield Gas Co. is reported to have purchased the plant of the Windsor Locks Electric Light Co. It is proposed to construct a gas plant next year in Thompsonville and pipe gas through that place and outside, including Windsor Locks. It is also reported to be the purpose of the company to use the present water power for the generation of electricity, and install gas engines for furnishing such additional electricity as is wanted.

Washington, D. C.—The following are the bids opened on Nov. 8 at the office of Elliott Woods, Supt. U. S. Capitol Bldg. and Grounds, for electric lighting fixtures for the U. S. Capitol: (*a*) Senate wing, (*b*) House wing: Lawrence Gas Fixture Co., Philadelphia, Pa., *a* and *b*, total $9,500; Lloyd Garrett Co., Philadelphia, Pa., *a* $3,100, *b* $6,400; Mitchell-Vance Co., New York, N. Y., *a* $5,650, *b* $3,815; the Enos Co., New York, N. Y., *a* $5,290, *b* $4,210; Horn & Brannen Co., Philadelphia, Pa., *a* (2 bids) $5,200 and $5,475, *b* (2 bids) $4,300 and $4,025.

Bids will be received at the Bureau Supplies and Accounts, Navy Dept., Washington, until Nov. 28, to furnish at the Navy Yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C.; and Norfolk, Va., a quantity of Naval Supplies as follows: Schedule 224, Arc lamps, wire, conduit, panel boards; electrical supplies; Portland cement; sand; broken stone; vitr. pipe; sewer pipe; iron pipe and fittings; "Cochrane" separator, etc. Schedule 225, Ventilating sets, etc. Schedule 226, Steel bolts and rivets; galvanized steel; steel forgings, generating tubes, etc. Schedule 227, Motor, electrically driven grinders and drills; sheet copper; steel castings; galvanized sheet steel, etc. Schedule 228, Straightening press; shaft straightener, bar steel, etc. Schedule 229, Hydraulic jacks; blacksmith's forges; plain and galvanized sheet steel; brass; copper; drills; Portland cement, etc. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

**Jacksonville, Fla.*—The Allis-Chalmers Co., of Milwaukee, Wis., is reported to have secured the contract for the purchase of two 500-kw. steam turbine electric generators, with necessary equipment, for $36,135.

Edwardsville, Ill.—J. L. Fox, of St. Louis, Mo., is stated to have petitioned Council for a franchise to construct and operate a gas plant in Edwardsville.

Ardmore, Ind. Ter.—The City Council is reported to have granted E. I. Mairs, Frank Mairs, J. S. D. Nealy and L. S. Nealy, all of Lima, O., a franchise for a gas plant.

Conrad, Ia.—The Conrad Gas, Light & Fuel Co. is reported incorporated, with a capital of $4,000 by John R. Gier and others.

**Ft. Leavenworth, Kan.*—The contract for extending the electric lighting system at Ft. Leavenworth (bids opened Oct. 4) has been awarded to Tholen Bros., of Leavenworth. Capt. J. E. Normoyle, Q. M., U. S. A.

Abbeville, La.—Wm. McIntosh, of Abbeville, is reported to be preparing plans and estimates for the construction of an electric light plant.

Quincy, Mass.—A petition is reported to have been presented to City Council, asking that the city take measures to secure by purchase or otherwise, a municipal gas or electric light plant.

Fairview (Wayne County), Mich.—Village Trustee Matt Kramer is reported interested in the construction of an electric light plant.

Belle Plaine, Minn.—It is reported that bids are wanted until Nov. 27 for an electric light plant on which a 20-year franchise will be given. Bids to state what 16 street arc lights of 1,600 to 2,000 c.p. will be furnished per month for, and cost of each additional arc light; also cost of incandescent lights for commercial use. J. E. Townsend, Boro. Clk.

Bowling Green, Mo.—The Pike County Light & Power Co. is reported incorporated with a capital of $7,000 by H. Ledford and I. Dempsey.

Independence, Mo.—The City Council is reported to have granted a franchise to the General Light, Heat & Power Co., subject to the approval of citizens.

St. Louis, Mo.—The Laclede Gas & Light Co. is reported to have decided to erect a new gas plant in the 11th ward.

Fremont, Neb.—S. F. Stiles, City Clk., writes that about $5,000 will be expended for improvements to the electric light plant. J. H. Mathews, Supt.

Perth Amboy, N. J.—C. D. Baynton, Secy. Citizens' Electric Light, Heat & Power Co. writes that it is proposed to construct an electric light and power plant.

New Brunswick, N. J.—A committee of citizens has appointed former City Surveyor A. Atkinson, to look into the matter of constructing an electric light plant. No action on the matter has yet been taken by the city officials.

Brooklyn, N. Y.—Bids will be received until Nov. 27 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing electric equipment in School 149, Boro. Brooklyn.

Sandy Hill, N. Y.—The Village Trus. are reported to have granted a franchise to the United Gas, Electric Light & Fuel Co.

Waterford, N. Y.—The Village Trus. are stated to have adopted a resolution, directing the Light Com., President, Attorney and Engineer, to ascertain the cost of constructing and operating an electric light plant.

Buffalo, N. Y.—At the election Nov. 7 the citizens voted in favor of a municipal lighting plant.

**New York, N. Y.*—Peet, McAnerney & Powers, 225- 4th Ave., have secured the contract for installing the electric equipment in School 42, Bronx Boro. (bids opened Nov. 13) for $9,286.

**Geneva, N. Y.*—The Bd. of Pub. Wks. is reported to have awarded the contract for installing a conduit system on Castle St. to F. J. Baxter, of Syracuse, for $3,144.

Little Falls, N. Y.—The Council on Nov. 9 granted the Hudson River Electric Power Co., a 50-yr. franchise to build and operate its lines in Little Falls.

Lenoir, N. C.—The Citizens Light & Power Co., of Lenoir, is reported incorporated, with a capital of $25,000, to establish a light and power plant. Incorporators, H. F. Newland and W. B. Ivey.

Yadkin College, N. C.—The Yadkin Development Co. is reported formed by Dock Hartley, of Yadkin College; Prof. J. M. Bandy, of Greensboro, and others, to develop water power for electrical purpose in Davidson County. It is proposed to construct a canal 11 miles in length from a point on Yadkin River at Yadkin College, to a point near Linwood.

Mooresville, N. C.—Bids will be received until Nov. 20 by Major A. L. Starr, for $10,000 electric light bonds.

Roanoke Rapids, N C.—H. C. Cooper, Gen. Mgr., Roanoke Rapids Power Co., writes that contract for the new power plant will probably not be let before the Spring.

Greenville, O.—A franchise is reported to have been granted to the Ohio & Indiana Natural & Illuminating Gas Co., to construct and maintain an artificial gas plant.

Elgin, Ore.—The Grand Ronde Power Co. (Fred. Housch, Engr., La Grande, Ore.) is to extend its line to Elgin, and furnish light and power; probable cost of work $20,000.

Philadelphia, Pa.—S. L. Brumbaugh, Gen. Mgr., Juniata Hydro Electric Co., Perry Bldg., writes in regard to the construction of the proposed electric plant on Juniata River, that the total cost of the work will be about $1,000,000. Bids for excavation, steam shovel work, etc., will be received in about 30 days. Bids for electrical equipment will be received about Jan. 1. Engineer, Wm. H. Cushman.

Homestead, Pa.—The Homestead Light, Heat & Power Co. is reported incorporated, with a capital of $5,000, by J. Clyde Miller and J. Jos. Gibson, of Homestead, and others.

Aberdeen, S. D.—F. W. Raymond, City Aud., writes that the citizens voted Nov. 9 to construct a municipal electric light plant.

Midlothian, Tex.—The Midlothian Ice, Light & Water Co. is reported incorporated, with a capital of $20,000 by C. A. Moore, W. W. Meyer and others, all of Midlothian.

Richmond, Va.—Howard Bruce, in his report to Council on the city gas works, recommends an expenditure of $709,000 for improvements, to include a 2,000,000 cu. ft. holder and pumping line complete; the installation of by-pass connections to present 400,000 cu. ft. holder and the rebuilding of the holder, the laying of 15 miles of small mains, mostly 6 and 8-in., to replace the present 3-in. pipes, etc.

**Items marked thus give the names of parties awarded contracts.*

Milwaukee, Wis.—The only bid received on Nov. 8 for lighting the city by electricity is stated to have been submitted by the Milwaukee Electric Ry. & Lighting Co. It offers to light the city at $60 per lamp per yr. for a 10-yr. contract; $65 per yr. for a 5-yr. contract, for any term less than 5 years, $81 per lamp per yr., fed by overhead conduits, and $99 per lamp per yr. if fed by underground conduits.

Winnipeg, Man.—Bids will be received by J. C. Gibson, Chmn. Fire, Water & Light Com., until Dec. 18, for supply of producer gas plant of capacity of 2,500 continuous engine brake h.p., as advertised in The Engineering Record.

Halifax, N. S.—F. W. Doane, City Engr., writes it is quite possible that a municipal plant may be decided upon for Halifax, but at present the city is simply obtaining information in referecnce to the experience of other cities with municipally owned plants.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Douglas, Ariz.—The Douglas Street Ry. Co. has secured a franchise for an electric railroad.

Van Buren, Ark.—The Van Buren Electric Light & Power Co.'s property is reported to have been transferred to the Ft. Smith, Van Buren Bridge & Traction Co. This deal assures the connecting of the two towns by an electric railway and the building of a railroad, electric and general toll bridge across the Arkansas River.

Capitola, Cal.—It is stated that the Union Traction Co. (W. J. Forgens, Gen. Mgr., Santa Cruz) will commence work on the proposed extension from Capitola to Soquel as soon as all rights of way have been secured. The new electric road will be known as the Santa Cruz, Capitola & Watsonville Electric Ry.

Vallejo, Cal.—The Vallejo, Benicia & Napa Valley Ry. Co. (M. K. Miller, Ch. Engr.) is reported to have in contemplation the construction of extensions to Calistoga and other points.

San Bernardino, Cal. — The San Bernardino Valley Traction Co. (John H. Fisher, Gen. Mgr.) is reported to have announced its intention of building a double track connecting San Bernardino with Riverside. A. C. Denman, Jr., Gen. Mgr.

Los Angeles, Cal.—It is announced that rights of way have been received by H. E. Huntington whereby the interurban cars of the Pacific Electric Ry. Co. will eventually enter the Huntington Bldg., at 6th and Main Sts., over an elevated structure that will connect with the E. 9th St. line at Santee St. Surface lines will be constructed under this structure for handling express cars, a franchise for this purpose having been already granted by the City Council.

San Francisco, Cal.—It is stated that the California Midland Ry. Co., recently incorporated, will construct the projected electric railway system connecting Grass Valley, Auburn and Marysville. About 70 miles of standard-gauge road will be built. Capital, $3,000,000. John Martin, Eugene J. de Sabla and Walter J. McLean are reported interested.

Ft. Wayne, Ind.—The contract for the construction of the interurban railway from Ft. Wayne to South Bend is stated to have been awarded to the Indiana and Illinois Constr. Co., and Mr. Weeden, of Elwood, Ind. The road will be 80 miles in length. C. F. Knowlton, S. T. Roberts and others are reported interested.

Sioux City, Ia.—The Sioux City & Ireton Interurban Ry. Co. is reported to have announced that the line from Sioux City to Ireton will be constructed. The plan is eventually to continue the line to Spirit Lake. Surveyors are now at work laying out the route.

Topeka, Kan.—A charter is stated to have been granted to the Falls City, Sycamore, Sabetha & Southwestern R. R. Co., capital $100,000. The company proposes to build an electric railway from Sycamore Springs, through Nemaha, Pottawatomie, Jackson and Shawnee Counties to Topeka. A line is also proposed to run in a westerly direction from Sycamore Springs to the west line of the State, through the counties of Marshall, Cloud, Jewell, Smith, Phillips and Thomas. Incorporators: Sam'l Kimmel, E. S. Towle, of Falls City, Neb.; E. V. Kauffman, of Sabetha; W. A. S. Bird, of Topeka, and others.

Carthage, Mo.—It is stated that $200,000 was raised at a public meeting held recently for the purpose of building an electric railway between Carthage and points to the northwest, including Purcell and Neck City and Asbury. A committee composed of 5 local business men had articles of incorporation drawn up Nov. 5, and these will be filed with the Secretary of State. It is probable that the new line will operate motor cars.

Jersey City, N. J.—A certificate abandoning a proposed branch of the Hudson & Manhattan Ry. Co., 1½ miles in length, in Jersey City, is reported to have been filed with the Secretary of State. To take the place of the abandoned road the company proposes to construct a road from Jersey City to Newark. The road will be entirely below the surface of the ground, or of subway construction.

**Brooklyn, N. Y.*—The following are the bids in detail opened on Nov. 2 by the Brooklyn Grade Crossing Comn. for constructing Section 2 of the Brighton Beach Improvement: (John H. Dwyer, Engr. in Charge): (*a*) Chas. Cranford, 44 Court St. (awarded contract); (*b*) Uvalde Asphalt Paving Co.; (*c*) Jas. A. Hart Co.; (*d*) Beinhauer & See; (*e*) Jas. H. Holmes; (*f*) W. H. Gahagan; (*g*) J. F. Shields; (*h*) J. G. White & Co.; (*i*) Degnon Contr. Co.; (*j*) Monolith Reinforced Concrete Co.; (*k*) Ford & Waldo; (*l*) Borough Constr. Co.:

	**a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
230,000 cu. yds. earth excav.	$0.73½	$0.60	$0.82	$0.87	$0.87½	$0.94	$1.00	$1.35	$1.31	$1.19	$1.47	$1.40
43,500 cu. yds. concrete	5.20	6.25	5.80	5.90	6.45	7.15	8.00	7.83	7.00	7.89	7.50	9.50
1,900 cu. yds. reinforced concrete at stations	15.15	13.00	7.75	10.54	11.19	9.60	8.25	11.20	16.35	20.00	12.00	13.65
22,000 sq. ft. water proofing	.60	.50	.21	.10	.33	.60	.20	.25	.40	.07	.20	.14
26,000 lbs. steel columns	.05½	.04	.12	.09½	.07	.06½	.06	.09	.04¼	.06	.05	.10
13,500 sq. ft. cement platforms	.16	.35	.18	.25	.13	.18	.25	.22	.20	.22	.18	.33
150,000 duct ft. vitr. clay conduits	.08	.09	.13	.09½	.13	.14½	.10	.10	.10	.07	.10	.11
38 M.H. steel I-beams, etc., in manholes	36.40	40.00	50.00	27.00	11.00	65.00	50.00	20.00	50.00	45.00	30.00	26.10
1,800 lin. ft. 6-in. pipe sewer	.17	.25	.20	.14	.39	.75	.16	.17	.20	.18	.70	.21
1,800 lin. ft. 12-in. pipe sewer	.46	.90	.55	.44	.69	2.35	.45	.49	.60	.60	1.00	.63
700 lin. ft. 18-in. pipe sewer	.80	1.25	1.00	.77	1.11	2.90	.78	.86	1.25	1.00	1.30	1.19
3,700 lin. ft. 24-in. pipe sewer	1.40	1.50	1.75	1.42	1.59	3.90	1.70	1.60	2.00	2.30	1.75	1.80
4,000 sq. yds. granite block pavement	2.45	2.10	2.40	2.50	2.31	3.00	3.00	3.25	3.00	6.00	2.75	2.86
50,000 lbs. c. i. for drain covers, etc	.03½	.04	.05	.04½	.05	.03½	.03½	.03	.03	.06	.04	.05
Reconstruction of Foster Ave. sewer (lump sum)	19,150	17,000	23,500	30,000	17,000	20,500	30,000	26,800	35,000	30,000	32,000	32,455
450 cu. yds. reinforced concrete on highway bridges	10.00	13.00	10.00	22.60	9.75	11.00	8.25	13.00	15.00	20.00	8.50	13.65
600 cu. yds. cinder concrete on highway bridges	3.80	5.00	4.25	5.00	4.50	6.00	5.75	4.75	7.30	6.00	8.50	6.82
1,800 sq. yds. wood block pav't. on highway bridges	2.00	2.75	3.00	2.75	2.75	2.75	3.03	3.10	4.00	1.50	3.00	4.78
9,300 sq. ft. cement sidewalks on highway bridges	.08	.18	.30	.20	.13	.27	.18	.40	1.20	.22	.18	.36
760 lin. ft. concrete curb on highway bridges	1.45	1.25	1.50	.75	.61	.75	.75	.75	.65	1.00	.80	1.02
50 cu. yds. brick masonry	15.00	15.00	25.00	18.00	13.00	11.00	15.00	12.50	14.00	25.00	10.00	20.47
Granite block pavement, sand foundation, per sq. yd.	2.30	2.10	2.40	2.65	2.03	2.75	3.00	3.50	2.75	6.00	3.00	4.09
Granite block pavement, concrete foundation, per sq. yd.	3.15	2.50	3.00	4.00	3.00	3.25	3.75	4.30	4.00	7.00	3.75	4.78
Macadam pavement, per sq. yd	1.00	.90	1.25	1.00	.65	.80	1.60	1.75	1.50	1.35	.75	1.02
Asphalt pavement, per sq. yd	1.60	1.50	2.40	2.55	3.00	2.60	2.50	2.35	3.00	2.50	1.40	4.78
Concrete foundation, any pavement, per sq. yd	.90	.70	1.00	1.65	5.25	1.00	.80	.75	6.00	4.50	.75	2.05
200 lin. ft. cement curb	.60	.60	1.00	.50	.51	.60	.30	1.25	1.00	1.00	.80	1.02
4,950 sq. ft. cement sidewalks	.14	.18	.20	.20	.19	.16	.25	.20	.20	.30	.18	.27
Blue stone flag, per sq. ft	.29	.30	.30	.15	.21	.29	.30	.30	.25	.20	.25	.27
1,200 sq. ft. resetting stone flag	.03	.05	.10	.05	.05	.06	.08	.10	.05	.15	.05	.14
100 lin. ft. resetting stone curb	.09	.25	.35	.20	.13	.16	.10	.25	.30	1.00	.20	.21
Repaving old granite or Belgian block, per sq. yd.	.35	.50	.50	.45	.75	.40	.75	1.00	1.00	3.00	.50	.55
10. M. ft. Y. P. planking and stringers	38.00	50.00	55.00	55.00	41.00	42.00	38.00	54.00	40.00	60.00	50.00	47.75
Force account, extra work, per cent	10%	15%	10%	15%	15%	10%	10%	15%	15%	15%	20%	20%
Date of completion	May 1, 1907.	Mar. 1, 1907.	Dec. 1, 1907.	Dec. 1, 1907.	Nov. 1, 1907.	June 1, 1907.	Nov. 1, 1907.	Aug. 1, 1907.	Nov. 15, 1907.	Dec. 25, 1907.	Jan. 1, 1908.	Sep. 30, 1907.
Total	$505,996	$521,025	$550,845	$572,354	$587,069	$661,846	$688,988	$742,285	$756,949	$762,730	$785,603	$870,591

Lyons, N. Y.—It is stated that an electric railway is projected from Lyons to Sodus Bay. Among those interested in the propoition are: Chas. H. Betts, Edson W. Hamn and Jas. D. Bashford.

Cairo, N. Y.—The Catskill Mountain & Mohawk Valley Ry. of Oneonta, is reported incorporated to build and operate an electric surface railroad from Cairo to Oneonta, a distance of 78 miles. The capital is $2,000,000 and the directors are: Edgar P. Holdridge, of New York; Herbert S. Loundsbury, Port Chester; Marcus Hirshfield, Rochester; George W. Kendall, Stamford, and others.

High Point, N. C.—The High Point-Winston-Salem Ry. Co. is reported to have received a charter to operate electric, local and interurban lines. Capital, $450,000. C. C. Yeller, Bloomberg, Pa.; J. H. Millis, R. A., and R. H. Wheeler, of High Point, are reported interested.

Marietta, O.—The Marietta, Belore, Parkersburg & Galipolis Traction Co. is reported incorporated, with a preliminary capital of $1,500, to build an electric line from Marietta to Galipolis, paralleling the Ohio River. Albert E. Boone, of Zanesville, is reported interested.

**Portland, Ore.*—The Oregon Water Power & Railway Co. is stated to have placed a $150,000 contract for machinery with Manning, Maxwell & Moore, the Westinghouse people, and other firms in New York, for installation in its Cazadero plant. The machinery consists of electric transformers, generators and turbine wheels sufficient to generate 20,000 h.p. from the Clackamas River.

Salem, Ore.—The Citizens' Electric Light & Power Co., of Salem, is reported to be arranging for the right of way for the proposed electric railway between Salem and Portland. The present intention is to build the road from Eugene, via Albany, Salem and Oregon City, to Portland.

Uniontown, Pa.—The construction of an electric railway from Uniontown to Waynesburg is reported to have been announced. The Uniontown & Waynesburg St. Ry. Co. is formed with a capital of $120,000. It is proposed to operate a line 20 miles long. Geo. L. Hibbs, Pres.

El Paso, Tex.—The East El Paso Townsite Co. is reported to have announced that it has entered into a contract with the El Paso Electric Ry. Co. to extend its line through that addition to the city. It is stated that this line will be ultimately extended to Fort Bliss.

Waxahachie, Tex.—The City Council is stated to have granted a franchise over the street of the city to J. S. Daugherty and associates for the proposed interurban electric railway that is proposed to run from Dallas to Waxahachie. The survey for the road is now being made. It will be about 35 miles long.

Houston, Tex.—The Houston Electric Co. is stated to have perfected plans for important extensions of its electric railway lines in Houston and for other improvements. New car houses and repair shops will be erected at a cost of about $80,000. Stone & Webster, of Boston, Mass., are reported interested.

Buckhannon, W. Va.—W. E. Hildebrand, of Clarksburg, is reported interested in a plan to build an electric railway from Buckhannon to Clarksburg. He says the intention is to build a trolley system from Pittsburg through West Virginia.

New Westminster, B. C.—It is stated that the British Columbia Electric Ry. Co. will probably build a branch line from this city to the Fraser River saw mills, at an estimated cost of $35,000.

Quebec, Que.—Engineers are stated to have commenced the surveys of the proposed electric railway to the Saguenay River, to be constructed by a company with which Rudolphe Forget, of the Montreal Street Railway, is connected. There will be extensive rock cutting for some 12 miles.

RAILROADS.

Notes Arranged Alphabetically by States.

Troy, Ala.—The Pea River Valley & Gulf R. R. Co. reported incorporated, with a capital of $25,000, to build a railroad from Opelika, Ala., to Portland, Fla., a distance of about 200 miles. Headquarters to be at Troy.

**Atlanta, Ga.*—M. T. Edgerton, Prudential Bldg., Secy. Atlanta & Carolina Ry. Co., writes that the Atlanta & Carolina Constr. Co. has secured the general contract for the construction of the entire line.

Galesburg, Ill.—We are informed that the Galesburg, Milwaukee & Southern R. R. Co., of Galesburg, is letting contracts for the construction of its line in sections. The length of this proposed line will be 250 miles, and will be constructed in Illinois and Wisconsin, and to the city of Louisiana in the state of Missouri. The motive power will be steam. Robt. A. Young, Jr., of Galesburg, is interested. Nathan Eisenlord is Engr. in charge.

Jeffersonville, Ind.—It is stated that the Imperial Mining Co. (D. C. Peyton, Engr., Jeffersonville) contemplates building 9 miles of narrow-gauge railroad and will be in the market for complete equipment. Possibly the line will be built and equipped the present season.

Hopkinsiville; Ky.—The Illinois Central R. R. Co. (H. McCourt, Gen. Supt., Southern Lines, Memphis, Tenn.) is reported to have decided to relay and reballast the track of the Tennessee Central R. R., lately acquired from Hopkinsville to Nashville, Tenn.

Baltimore, Md.—A grade crossing commission, consisting of City Engr. B. T. Fendall, Daniel Rider, of the Chamber of Commerce; Jas. Bond, of the Merchants and Mfgrs. Assoc.; John N. Branin and John M. Glenn, representing South Baltimore, is reported to have been selected, to confer with the Baltimore & Ohio R. R. Co., looking to the establishment of overhead crossings for tracks in South Baltimore.

Kansas City, Mo.—The Kansas City Southern R. R. Co. (A. F. Rust, Resident Engr., Kansas City) is reported to be planning to expend $5,000,000 for improvements and betterments. Part of the amount will be spent at Kansas City, and the balance for heavier rails and steel bridges. Several extensions have been planned, including one to New Orleans.

St. Joseph, Mo.—The Harriman interests are reported to have secured control of and will build the St. Joseph, Albany & Des Moines R. R., between St. Joseph, Mo., and Des Moines, Ia. The road was promoted by C. F. Mordaunt, of Chicago, Ill. The line is 192 miles in length and most of the right of way has been secured.

**Items marked thus give the names of parties awarded contracts.*

Basin, Mont.—M. L. Hewitt, of Basin, is reported interested in the construction of a railroad from Basin and Elliston to Kalispell.

Buffalo, N. Y.—The Grade Crossing Comrs. and the New York Central R. R. Co. (F. W. Everett, Div. Supt., Buffalo) are reported to have reached an agreement for abolishing all grade crossings specified in act of 1903. The railroad agrees to pay 65 per cent. of the cost of building the structures and to stand the same proportion of all consequential damages to property. The city agrees to stand the remaining 35 per cent. The R. R. Co. also agrees to stand all cost of renewing and maintaining structures built under the agreement. The commissioners hope that all the other railroads entering Buffalo will follow suit.

Scarsdale, N. Y.—The New York Central R. R. Co. (Ira A. McCormack, Mgr. Harlem Line, N. Y. City) is reported to be considering the question of eliminating the grade crossing over the Harlem River between Scarsdale and Greenberg at Fisher St. The cost of the improvement is estimated at $65,000, one-half of which will be paid by the railroad company.

Deposit, N. Y.—The Delaware & Southern R. R. Co. of Deposit is reported incorporated to build and operate a steam railroad from Deposit to Trout Creek, a distance of 17 miles; capital, $170,000. Directors, Chas. P. Knapp, Deposit; Wm. O. Dennis, Trout Creek; Geo. H. Perigo, Scranton, Pa., and others.

Oklahoma City, Okla. Ter.—A charter has been granted to the Pueblo, Oklahoma City & New Orelans Ry. Co., of Oklahoma City, with a capital of $3,900,000, to construct a railroad from Pueblo, Colo., to New Orleans, passing through the following Oklahoma counties: Pottawatomie, Cleveland, Oklahoma, Canadian, Kingfisher, Blaine, Dewey, Woods, Woodward and Beaver. Estimated cost is $21,000,000 and the estimated length is 1,050 miles. Incorporators: J. H. Wheeler, W. C. Burke, R. A. Wooldridge and others, all of Oklahoma City.

Portland, Ore.—The Northern Pacific Terminal Co. is reported to have decided to erect a system of elevated streets over the railroad tracks in the terminal yards in this city at a cost of upward of $200,000.

Galeton, Pa.—Henry Herden, of Galeton, Ch. Engr., Buffalo & Susquehanna R. R. Co., writes that a survey for the construction of a "cut off" is in progress in two localities, but nothing certain yet as to where it will be built.

Conway, S. C.—The Eddy Lake & North R. R. Co., is reported incorporated, with a capital of $100,000, to build a standard gauge railroad, 35 miles in length, from Marion through Leggette, Britton's Neck, Gallivant's Ferry, Dog Bluff and Buck Townships to Eddy Lake, in Horry County. Wm. Burgan and Norman James, of Baltimore, Md., and R. B. Scarborough, of Conway, are among the incorporators.

Rapid City, S. D.—The White River Valley R. R. Co. is stated to have filed with the Secy. of State a resolution of extension from the Lyman County terminus to Rapid City across the counties of Lyman, Stanley and Pennington.

Richmond, Va.—Bids will be received until Dec. 1 by C. P. E. Burgwyn, Ch. Engr., Richmond & Chesapeake Ry. Co., 519 Mutual Bldg., for constructing portions of said road.

Bellingham, Wash.—Frank C. Teck, Secy. Chamber of Commerce, writes in regard to railroad construction here, that it is proposed to raise a cash and land subsidy of $1,400,000 for a standard gauge railroad from Bellingham to Spokane by the most direct route crossing Cascade Mountains in Skagit on Whatcom County, about 300 miles. The subsidy conditions require that work commence not later than June, 1907, and the road must be completed and in operation by June, 1910.

Washburn, Wis.—The Northern Pacific R. R. Co. (E. J. Pearson, Ch. Engr., St. Paul, Minn.) is reported to have decided to construct a short-line from Washburn to connect with the main line at Ashland Junction, a distance of about 8 miles

Toronto, Ont.—Ald. Geary's special committee on level crossings is reported to have been furnished with blue prints, showing the proposed scheme of the Grand Trunk Ry. Co. (J. Hobson, Ch. Engr., Montreal, Que.) to depress its tracks west of Bathurst St. to Sunnyside, and elevating them from that point to the Humber, providing an undercrossing at Indian Road. There was also provided an estimate of the cost of the work, showing a proposed expenditure of over $1,000,000.

Guelph, Ont.—The Guelph-Goderich Ry. Co. is reported to have decided to construct branch roads through Waterloo County, a distance of about 15 miles.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Talladega, Ala.—It is stated that the Co. Comrs. have engaged Chamberlain & Co., of Birmingham, to prepare plans for the court house, to cost not more than $60,000.

Los Angeles, Cal.—It is reported that Parkinson & Bergstrom have prepared plans for a $300,000 home for the aged, to be erected by the Little Sisters of the Poor.

Fresno, Cal.—W. H. Ryan, City Clk., writes that E. Mathewson is architect for the proposed city hall, for which the citizens on Oct. 31 voted to issue $75,000 bonds.

Colorado Springs, Colo.—The physicians of the city are said to be interested in the erection of a $100,000 hospital. Dr. W. A. Campbell may be able to give further information.

The following are the bids opened on Nov. 14 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post-Office and Court House at Colorado Springs: John Borden, Fort Worth, Tex., $119,250; Dieter & Wenzel, Joplin, Mo., $118,862; Wm. Weber, Huntington, W. Va., $108,000; Gillis Bros. Co., Colorado Springs, $118,899; G. F. Atkinson, Colorado Springs, $119,950; F. L. Stevenson Contract. Co., Dallas, Tex., $111,900; A. B. Stannard, New York, N. Y., $118,900; H. A. Paine, Albert Lea, Minn., $112,000; North Western Constr. Co., Wapeton, N. D., $123,799; W. H. Maxwell, Laramie, Wyo., $105,792; J. H. Freise, So. Omaha, Neb., $106,470; The Pyset Co., Pueblo, $119,997; Morse Constr. Co., Topeka, Kan., $118,000; T. H. O'Neal, Denver, $128,900.

Hartford, Conn.—Plans will be received until Feb. 1 by A. W. Mitchell, Compt., State Capitol, for a State Arsenal and Armory, to be located on Broad St., this city.

Washington, D. C.—Bids will be received until Nov. 25 by Elliott Woods, Supt. Bldgs. and Grounds, Washington, for laying the rough brick work for the office building of the U. S. Senate.

Milledgeville, Ga.—The Prison Comn., of Atlanta, has accepted the plans for the proposed State Reformatory which is to be erected at Milledgeville, and it is stated will soon ask bids for its construction. A. C. Bruce, of Atlanta is the archt.

Atlanta, Ga.—The Trus. of the Presbyterian Hospital, it is stated, are contemplating the erection of a new building, the first wing to be erected in the near future, at a cost of about $50,000.

Griffin, Ga.—The Co. Comrs., it is stated, have secured a site and Chamberlin & Co., of Birmingham, Ala., are preparing plans for a court house, which is to be erected at a cost of $75,000.

**Marion, Kan.*—D. D. McIntosh, Co. Clk., writes that contracts for constructing the court house (bids opened Nov. 9) have been awarded as follows: general construction to J. B. Betts, Topeka, $41,874; heating and plumbing, Falk & Co., of McPherson, for $2,735, and electric wiring, E. P. Jordan, Topeka, $240.

**Ft. Leavenworth, Kan.*—The contract for constructing five double sets of lieutenants' quarters (bids opened Oct. 27) have been awarded as follows: Construction, to Fuller & Garrett, Leavenworth; plumbing, to Jas. Foley, Leavenworth, and electric wiring to Wm. A. Corrao Electric Co., St. Louis, Mo. J. E. Normoyle, Capt. & Q. M., U. S. A.

Natchitoches, La.—Bids will be received until Jan. 4 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for constructing complete the U. S. Post-Office at Natchitoches.

Monroe, La.—The Police Jury on Nov. 7, it is stated, passed a resolution authorizing the Jail Com. to receive plans and specifications for a new jail, the cost not to exceed $50,000.

It is stated that plans are being prepared for a city hall which is to be erected at a cost of $75,000.

Baltimore, Md.—The following are reported to be the bids received Nov. 8 by the Bd. of Awards for remodeling the old City Hall on Holliday St., which were rejected; the work will probably be done by day labor: Henry S. Rippel, $24,400; Chas. L. Stockhausen, $27,200.

Bids will be received until Dec. 6 by the Bd. of Awards (E. Clay Timanus, Pres.) for erecting the Retail Market and Maryland Inst., on Centre Market Space, south of Baltimore St.; separate bids must be submitted on the foundation and superstructure. Plans and specifications may be obtained upon a deposit of $50, the same to be refunded if plans are returned before opening of bids; should the drawings and specifications be damaged or defaced, $10 will be retained.

Annapolis, Md.—Bids will be received until Dec. 20 at the Navy Dept., Washington, D. C., for the foundation for the first building, experiment station, Annapolis, Md. A set of drawings may be obtained at the office of the Supt. of the U. S. Naval Academy by depositing $5, which will be refunded on their return.

**Springfield, Mass.*—Geo. H. McClean, of Springfield, it is reported, has secured the contract for the ventilating and heating of the Hall of Records at $8,700.

D. B. Wesson, it is stated, intends erecting a maternity hospital at High and Myrtle Sts., to cost about $200,000.

North Adams, Mass.—The Hospital Trus. (Mrs. C. H. Williams, Pres.) it is stated, have announced that A. C. Houghton of North Adams, has offered to erect and equip a building for an operating room for the hospital, the cost will probably be $25,000.

Fairmont, Minn.—It is reported that bids will be received until Dec. 12 by the Bd. Co. Comrs. for erecting a 2-story stone and brick courthouse. Bell & Detweiler, Archts., Minneapolis. H. P. Edwards, Co. Aud.

Jackson, Mo.—Bids will be received until Dec. 18 by John G. Putz, Co. Treas., for $75,000 bonds for erecting a courthouse and jail.

**Overbrook, N. J.*—The Bd. of Freeholders at Newark on Nov. 9, it is stated, awarded the contract for erecting the building at the branch county hospital for the insane at Overbrook, to Richard E. Heningham, of Brooklyn, N. Y., at about $1,069,581.

Brooklyn, N. Y.—Borough Pres. Littleton has asked the Bd. of Estimate and Apportionment for $3,000,000 with which to erect a municipal building on the site of the present municipal building, the Polytechnic Inst., and all the buildings facing on Court St. and Murphy Park. Plans have been prepared for the building by McKim, Mead & White, 160 5th Ave., N. Y. City, and provide for a 4-story structure.

Plans have been filed for a 5-story brick storehouse, to be erected on Myrtle Ave. and N. Elliott Pl., at a cost of $25,000; owner, Fire Dept. of N. Y. City; archt., A. W. Ballard, 365 Jay St.

Utica, N. Y.—The citizens, it is stated, have voted in favor of appropriating $15,000 for the erection and equipment of a fire station in the vicinity of the 12th and 15th Wards.

Poughkeepsie, N. Y.—Bids will be received by T. E. McGarr, Secy. State Comn. in Lunacy, Albany, until Nov. 22 for furnishing and installing at the Hudson River State Hospital, Poughkeepsie, three 125-hp. and one 70-hp. horizontal tubular boilers, as advertised in The Engineering Record.

**New York, N. Y.*—Bids will be received until Nov. 23 by the Park Bd. (Sam'l. Parsons, Jr., Pres.) for furnishing material and erecting a small deer house in the New York Zoological Park, New York City.

The Trus. of the Metropolitan Museum of Art, it is stated, have approved the plans for the north wing, which is to be erected on the 5th Ave. side, at a cost of $1,250,000, exclusive of furnishings.

An ordinance was approved by the Mayor Nov. 8, authorizing the appropriating of $800,000 in addition to the $200,000 available for the purpose of erecting a tuberculosis hospital on Staten Island by the Dept. of Pub. Charities; also an ordinance appropriating $115,000 in addition to the $175,000 available for the erection of a municipal lodging house by the Dept. of Pub. Charities.

Reno, Nev.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., until Jan. 10 for the construction complete of U. S. Post Office at Reno, as advertised in The Engineering Record.

Ironton, O.—A. C. Robison Co., Aud., writes that the citizens have voted to issue $130,000 bonds for the erection of a court house.

Cleveland, O.—An ordinance has been passed by the Council authorizing the erection of a shelter house in Wade Park, to cost $12,000.

Youngstown, O.—It is stated that the citizens on Nov. 7 voted in favor of authorizing the Co. Comrs. to purchase a new site on which to erect a county building and court house.

Pinesville, O.—The citizens voted Nov. 7 to issue $160,000 bonds for the erection of a court house and $40,000 for a jail.

Guthrie, Okla. Ter.—The following are the bids opened on Nov. 7 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the low-pressure steam heating apparatus for the U. S. Post Office and Custom House: Lewis & Kitchen, Chicago, Ill., $4,977; Boswell, Hahn & Co., Wichita, Kan., $4,048; T. A. Maguire, Minneapolis., $4,443, and W. F. Power, Guthrie, $4,600.

Dawson, Pa.—J. C. Fulton, it is stated, has submitted plans for a town hall to be erected here.

Pittsburg, Pa.—The citizens on Nov. 7, it is stated, voted in favor of erecting a memorial building for the Grand Army of the Republic veterans of Allegheny County, to cost not less than $1,250,000. It is reported that no further action will probably be taken on the matter until the Bd. of Co. Comrs. meets in Jan. It is stated that plans for the building will be asked in competition.

**Deadwood, S. D.*—Mullen & Munn, of Deadwood, it is reported, have secured the contract to erect a court house at $71,322. Geo. V. Ayers, it is stated, has the contract for the plumbing of same at $6,076.

Deadwood, S. D.—Bids will be received until Nov. 21 by Wm. McLaughlin, Co. Aud., for $25,000 bonds for erecting a Co. court house.

Ft. Sam Houston, Tex.—It is reported that bids are to be asked immediately for the erection of a $75,000 hospital.

National Soldiers Home, Va.—Bids will be received until Dec. 4 by B. A. Beeson, Treas., for furnishing material and for plumbing buildings Nos. 41 and 44, and for changing electric light wires in building No. 14.

North Yakima, Wash.—The bids received Nov. 2 for erecting the Carnegie Library, it is stated, were all too high, and the plans are to be changed slightly so as to reduce the cost. Bebb & Mendell, Archts., Seattle.

Seattle, Wash.—The Co. Comrs., it is reported, have authorized the issue of $80,000 bonds for the erection of an armory for the National Guard.

It is reported that the Armory Comn. on Nov. 7 decided to ask bids for the erection of the armory which is to cost about $110,000, and to award the contract about Nov. 27. Kerr & Rogers, Archts., Hancock Bldg.

*The Rautman Plumbing & Htg. Co., of Seattle, has secured the contract for ventilating and heating the Seattle Public Library, for $17,354.

It is stated that a fire house is to be erected at 3d Ave. and Vine St., at a cost of $15,000.

Friendship, Wis.—It is stated that the Special Com. on building a court house in Friendship for Adams County, will recommend a $14,000 structure.

Marinette, Wis.—The State Comn., it is reported, has appropriated $90,000 for the erection of a tuberculosis sanitarium. Address Dr. E. F. Colter, Marinette.

Havana, Cuba.—See "Miscellaneous."

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The 5-story building on 20th St., occupied by the Moore & Handy Hardware Co., it is reported, was totally destroyed by fire on Nov. 7. Later reports state that it is the intention of the owner to rebuild at once.

Montgomery, Ala.—It is stated that bids are wanted until Dec. 8 for erecting a 4-story Y. M. C. A. building. Frank Lockwood, Archt., First National Bank Bldg.

Stockton, Cal.—It is stated that plans, specifications and estimates of the cost of erecting the Elks' Bldg. will be received by the Bd. of Directors of the Elks' Hall Assoc. until Dec. 6, the cost not to exceed $100,000. For information address the Bldg. Com. (W. C. White, Chmn.).

**Los Angeles, Cal.*—R. N. Lamberth, it is reported, has secured the contract to erect a 2-story building for A. J. Brown at $25,300.

San Luis Obispo, Cal.—The Ramona Hotel, a 300-room structure, it is reported, has been destroyed by fire.

Pueblo, Colo.—It is reported that a 3-story brick building is to be erected on Main and 2d Sts., at a cost of about $100,000. G. H. Whitcomb, owner.

Trinidad, Colo.—J. F. Hall, it is reported, is interested in a stock company which proposes erecting a $60,000 opera house here.

**Denver, Colo.*—A. R. Whitney & Co., it is reported, have secured the contract to erect a building at Champa and 16th Sts. for the Symes Estate, the cost to be about $300,000. Hunter & Hunter, of N. Y. City, it is stated, are the archts.

Bristol, Conn.—Wm. H. Cadwell, 213 Main St., New Britain, has prepared plans for a 2-story building, 39x70 ft., to be erected on Main St., to cost about $10,000.

Athens, Ga.—The erection of an alumni Y. M. C. A. and gymnasium building at the Univ. of Ga., to cost about $75,000, is reported under consideration.

Savannah, Ga.—The directors of the Y. M. C. A., it is stated, are contemplating the erection of a 4-story building.

Items marked thus give the names of parties awarded contracts.

Chicago, Ill.—Eugene S. Pike, it is stated, is having plans prepared by Howard Shaw, 175 Dearborn St., for a 16-story mercantile building, which he intends erecting at State and Monroe Sts., of granite, brick and terra cotta, at an estimated cost of $300,000.

Frank R. Blain, it is stated, will have plans completed in about a month by A. Sandegren, for an apartment hotel to be erected at 119 Monroe St. It will be 10 stories high, of fireproof and steel construction, and cost $200,000.

It is stated that it has been definitely decided to begin work after May 1, 1906, on an addition to the Carson, Pirie, Scott & Co.'s department store, the addition to be located at 145 to 153 State St. It will be 12-story of fireproof steel construction with white glazed terra-cotta front, have 10 passenger and one freight elevator and is estimated to cost $825,000. Otto Young is the owner and D. H. Burnham & Co., Ry. Exchange Bldg., are the architects.

Henry C. Lytton, Pres. of The Hub, it is reported, intends erecting an 8-story building at 217 State St.

J. K. Sebree, proprietor of the Saratoga European Hotel and Restaurant Co., 159 Dearborn St., has negotiations underway for a lease for 99 years of the ground, 88 x 190 ft., at 108 to 114 Madison St., on which he contemplates the erection of a hotel to cost possibly $1,000,000.

The Northern Trust Co. is trustee for the estate of the late Jas. C. King, who left a will providing for an endowment of $2,000,000 to be used in the erection and support of the Jas. C. King home for old men. It is the intention to locate and build the home as soon as the estate can be settled. Byron L. Smith, Pres. of the Trust Co., will be Pres. of the home.

S. S. Beman, 135 Adams St., is preparing plans for remodeling the Arcade building at 162 S. Clark St.; the improvements to cost $50,000.

Holabird & Roche, 1618 Monadnock Bldg., are preparing plans for a printing establishment to be built at 2320 Wabash Ave., for Clara E. Bass. It will be 2 stories, 133 x 181 ft., have pressed brick and stone front and cost $50,000.

The 3-story building at 1410 E. Ravenswood Park, occupied by the Tengwall File & Ledger Co., it is stated, was destroyed by fire on Nov. 9.

Bloomington, Ill.—The erection of a Y. M. C. A. bldg., to cost about $100,000, is reported under consideration. Campbell Holton, Chmn. Bldg. Com.

Muncie, Ind.—It is stated that the Mutual Home Savings Assoc. will receive bids until Dec. 1 for constructing a bank and apartment building. Alfred Grindle, Archt., Johnson Blk.

Concordia, Kan.—It is reported that Col. N. D. Brown has decided to erect a $20,000 opera house here.

**Horton, Kan.*—Chas. Fellows, of Topeka, it is reported, has secured the contract to erect the roundhouse here at a cost of about $75,000.

**Louisville, Ky.*—Herman Probst, general contractors for the Paul Jones Bldg., it is reported, has sub-let the contract for the structural iron work to Grainger & Co., at about $100,000.

New Orleans, La.—The New Orleans Council No. 714, of the Knights of Columbus, it is reported, is planning to raise $100,000, and contemplates erecting a home to cost about $50,000.

Morris M. Gleichman, of Cleveland, O., it is stated, is preparing plans for a theatre which is to be erected in this city by Miss Rose Melville at a cost of about $125,000. Walter S. Baldwin, Mgr. of the Baldwin-Melville Stock Co., may be able to give further information.

The Chas. A. Kaufman Co., it is stated, intends erecting a 6-story steel, concrete and stone building.

D. Bernhardt, it is reported, intends erecting a 6-story building on the site of the structure which was recently destroyed by fire.

Baltimore, Md.—A building permit has been granted to John A. Sheridan & Co. to erect a 4-story warehouse at High and Low Sts., to cost $30,000.

Henry J. Tinley, it is stated, is preparing plans for a 3-story warehouse, to be erected at 22 Centre Market Space by L. Lipsitz.

*The Baltimore Fidelity Warehouse Co., it is stated, has awarded a contract to the Woodruff-McLaughlin Co., to erect a warehouse on the water front near Lazaretto lighthouse, to be either 3 or 5 stories high, 141 x 159 ft.

**Wollaston, Mass.*—C. A. Dodge & Co., 8 Beacon St., Boston, have secured the contract for constructing additions to the works of the Tubular Rivet & Stud Co., at Wollaston, Mass.; cost, $40,000.

West Boylston, Mass.—It is stated that the Bd. of Directors of the Worcester Consolidated St. Ry. Co., Nov. 6, approved plans for a 1-story 40 x 60 ft. substation, which is to be erected in W. Boylston at a cost of $35,000.

Minneapolis, Minn.—The W. S. Nott Co., it is stated, has purchased a site on 2d Ave. N. and 3d St. and intends erecting next spring a 5-story warehouse to cost $125,000.

Duluth, Minn.—Ribenack Bros., prop. of the Lenox Hotel, it is stated, intend next spring erecting a 4-story addition to cost about $40,000.

Jackson, Miss.—T. D. Lott, Secy. Elks Assoc., writes that it is proposed to erect a lodge building at a cost of $25,000. Architect not yet selected.

**Joplin, Mo.*—Deiter & Wenzel, it is stated, have secured the contract to erect for L. P. Cunningham, a 3-story brick, stone and steel fireproof building at 6th St. and Virginia Ave., to cost $25,000.

St. Louis, Mo.—The Brown Shoe Co., it is reported, will erect a $300,000 building on Washington Ave., near Robbin Lane.

The Monticello Hotel, it is reported, has been leased to a company under the management of M. C. Irvine, and it is stated that improvements are to be made to the building at a cost of about $25,000.

*It is reported that F. J. Remmers has received the contract to erect a $50,000 building for Oscar Johnson.

Omaha, Neb.—A building permit has been granted to the Wright-Wilhelmy Co., to erect a 6-story brick warehouse at 10 and Jackson Sts., at a cost of $80,000.

Albany, N. Y.—The Odd Fellows, it is reported, are contemplating the erection of a state home in the vicinity of Albany, to cost about $75,000.

Buffalo, N. Y.—Plans have been filed by the General Ry. Signal Co. for a 3-story office building at 1728 Elmwood Ave., at a cost of $20,000.

Esenwein & Johnson, Ellicott Sq., it is reported, have prepared plans for a 12-story hotel, which is to be erected at Washington and Swan Sts., for E. M. Statler.

New York, N. Y.—The Bldg. Com. of the N. Y. Kindergarten Assoc., it is stated, is considering plans for a fireproof building which is to be erected at 10th Ave. and 42d St.

It is reported that the Royal Insurance Co. will erect a 16-story office building at William St. and Maiden Lane about Jan. 1, the total cost of the land and building to be about $1,250,000.

It is stated that an 8-story parish house is to be erected adjoining the Madison Ave. Baptist Church on E. 31st St., to cost $150,000. Dr. Kerr Boyce Tupper, Pastor.

Brooklyn, N. Y.—Plans have been filed for a 5-story brick extension to factory which is to be erected on Harrison St. and Tiffany Pl.; cost, $20,000; owner and archt., Walter & Co., 104 Harrison St.

High Point, N. C.—The Manufacturers Club members, it is stated, are considering the erection of a $50,000 building, to be used for club purposes, opera house and offices.

Cleveland, O.—The William Kaller & Son Co., it is reported, has accepted the plans of J. Milton Dyer, Cuyahoga Bldg., for the arcade building which they propose erecting at an estimated cost of $200,000.

**Findlay, O.*—Frank J. Herman, of Toledo, it is reported, has secured the contract to erect the Majestic Theatre here, the cost to be about $30,000.

Portland, Ore.—The Order of Washington, a Portland fraternal insurance organization, has secured a site on Morrison St., and will in the spring erect a building to cost about $25,000.

Allegheny, Pa.—A building permit has been granted to the trus. of Christ Episcopal Church to erect a stone parish house on Union Ave., to cost $36,000.

**Philadelphia, Pa.*—John R. Wiggins & Co., Heed Bldg., it is reported, have secured the contract to erect a 2-story and basement fireproof brick and terra cotta exchange building for the Bell Telephone Co., on Germantown and Southampton Aves., Chestnunt Hill, the cost to be about $45,000.

*The National Fireproofing Co., it is reported, has secured the contract for the interior reinforced concrete construction for the stores to be built by the Broad St. Realty Co., at Broad and Walnut Sts., at about $27,000.

*Rush J. Whiteside & Sons, 2115 Wallace St., it is stated, have secured a permit to erect a 2-story brick and stone office building at 131 S. 5th St., to cost $20,000.

Henry L. Reinhold, Jr., 1004 Chestnut St., it is stated, has prepared plans for a 3-story store and apartment building, which is to be erected on Broad and Arch Sts., at a cost of about $100,000.

Charleston, S. C.—The Atlanta Coast Line (E. B. Pleasants Ch. Engr., Wilmington, N. C.) and the Southern Ry. Co. (J. A. Heether, Div. Supt., Charleston) are reported to be receiving bids for the erection of a union station at Charleston; probable cost, $150,000.

Watertown, S. D.—The International Harvester Co., it is stated, intends erecting a brick fireproof warehouse and office building, 125 x 200 ft.

Chattanooga, Tenn.—The Fruit Growers' Express, it is reported, intends erecting a 4-story brick and stone warehouse, to cost $50,000.

Bristol, Tenn.—The erection of a $50,000 Y. M. C. A. bldg. is reported under consideration.

El Paso, Tex.—It is reported that the opera house and hotel have been destroyed by fire. Henry Myar, of Camden, Ark., is the owner. Later reports state that the owner intends rebuilding.

Richmond, Va.—The 3-story office and warehouse building of the Virginia Packing Co., near this city, it is reported, was totally destroyed by fire on Nov. 9.

The Southern Bell Telephone Co. intends erecting a 7-story fireproof steel building on E. Grace St.

Norfolk, Va.—The Dobson Hotel Co. (L. D. Dobson, Pres.), it is reported, has been incorporated with a capital of $25,000 for the purpose of erecting a hotel.

Olympia, Wash.—W. A. Ritchie, of Spokane, it is stated, is preparing plans for a 2-story business building to be erected on 4th and Franklin Sts., at a cost of $15,000.

North Yakima, Wash.—The Woodmen of the World, it is stated, will erect a 2-story public hall to cost $20,000.

Seattle, Wash.—It is reported that it is proposed to erect a Y. M. C. A. building to cost about $150,000.

V. W. Voorhees, it is reported, has prepared plans for a 6-story brick building which is to be erected at 4th and Pine Sts., at a cost of $55,000.

Bellingham, Wash.—Jas. Teague, of Seattle, it, is stated, is preparing plans for a 7-story building, which is to be erected by Alsop Bros.

Tacoma, Wash.—L. L. Doud, of the Doud Bros. Lumber Co., it is stated, is having plans prepared for a 5-story building which he intends erecting on C St., to cost $20,000.

Milwaukee, Wis.—The members of the St. Andrew Society, it is stated, are contemplating the erecting of a lodge building, to cost about $50,000.

Green Bay, Wis.—Kohl & Castle, of Chicago, Ill., it is stated, intend erecting a theatre here.

Vancouver, B. C.—Davis & Son, it is stated, have purchased a site at Cordova and Homer Sts., and intend erecting a 3-story stone structure to cost $30,000.

**Montreal, Que.*—The Quebec Bank, it is stated, have been granted a permit to erect a 2-story branch bank at Amherst and St. Catherine Sts., to cost $26,000. Cox & Amos, Archts., 185 St. James St.; J. W. Harris & Co., Contractors.

St. John, N. B.—The Salvation Army, it is stated, proposes in the spring erecting a 3-story brick building, to take the place of the present headquarters of No. 1 corps.

NEW YORK, N. Y.

Ridge and Stanton St., 8-story br. and stone shop and loft bldg.; c, $40,000; o, Lena Gorgel; a, M. Zipkes.

147 W. 24th St., 7-story br. and stone loft bldg.; c, $40,000; o, Louis Schulze; a, Frederick C. Zobel.

99th St. and 2d Ave., 4 6-story br. and stone stores and tenemts.; total c, $160,000; o, Hillman & Golding; a, Bernstein & Bernstein.

32 W. 100th St., 5-story br. and stone factory; c, $160,000; o, Schinasi Bros.; a, Gillespie & Carrel.

Bway and 159th St., 6-story br. and stone store and tenemt.; c, $100,000; o, Fluri Constr. Co.; a, Neville & Bagge.

216 Cherry St., 3 6-story br. and stone stores and tenemts.; total c, $150,000; o, Lowe & Jorrish; a, S. Sass.

Lafayette and Leonard Sts., 8-story br. and stone warehouse; c, $300,000; o, Israel Lippman; a, Schwartz & Gross.

Bway and 24th St., 12-story br. and stone hotel; c, $600,000; o, Francis S. Kinney; a, R. L. Daus.

1869 Bway., 4-story br. and stone garage; c, $150,000; o, Island Realty Co.; a, Jay H. Morgan.

9th Ave. and 15th St., 6-story br. and stone warehouse; c, $75,000; o, Mary A. Tuttle; a, Wm. A. Boring.

100th St. and 1st Ave., 6 6-story br. and stone tenemts. and stores; total c, $210,000; o, Berliner & Greenberg; a, Bernstein & Bernstein.

107th St. and 3d Ave., 2 6-story br. and stone tenemts.; c, $84,000; o, Jacobs & Hulkoff; a, E. A. Meyers.

Lenox Ave. and 143d St., 5 6-story br. and stone stores and tenemts.; total c, $270,000; o, Parnass & Dellon; a, Geo. F. Pelham.

179th St. and Arthur Ave., 5-story br. stores and tenemt.; c, $55,000; o, Catherine McNulty; a, Arthur Boehmer.

St. Anns Ave. and 145th St., 5-story br. stores and tenemts.; c, $35,000; o, Mandel Kaufman; a, Horenburger & Straub.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—The Lakeside congregation of the Methodist Church, it is stated, intend erecting next spring a brick edifice at 16th and Olive Sts., to cost $20,000. Rev. W. C. Watson, pastor.

Washington, D. C.—It is stated that the plans prepared by A. O. Von Herbulis, 1416 F St., N. W., for the stone fireproof residence to be erected on Baltimore St., west of Columbia Road, for the use of the delegate to the R. C. Church in this country, have been approved by a committee composed of Cardinal Gibbons, Archbishop Ryol of Philadelphia, and Archbishop Farley of New York.

Chicago, Ill.—John Duncan, 91 Dearborn St., is preparing plans for an apartment building, to be erected on Clark St. near Oak St. It will be 3-story, pressed brick and stone, and cost $125,000; also for an apartment building to be erected on Wilson Ave. It will be 3-story, of brick and stone, and cost $50,000; and also for an apartment building to be erected on Woodlawn Ave., to be 3-story, of brick and stone.

Reynolds and Brittain, the builders, are having plans prepared by N. S. Crowen, 85 Dearborn St., for an apartment bulding to be erected next spring on Sheridan Road, in the north shore district. It will be a 3-story structure, and cost about $80,000.

Jas. Burns, Clark and Washington Sts., has prepared plans for a 3-story apartment building, 99 x 170 ft., to be erected on Calumet Ave. and 44th St., for John D. Holmes, at a cost of $65,000.

C. L. Willey will improve the southeast corner of Michigan Boule. and 45th St. with a 3-story apartment building at a cost of $60,000.

Thos. McCall, 1710 Ry. Exchange, has made plans for a 3-story apartment building, 100 x 130 ft. ,to be built at 48th St. and Calumet Ave. for W. R. Hall at a cost of $60,000.

Zachary T. Davis, 79 Dearborn St., will let contracts shortly for an apartment building to be built on Cornell Ave. and 53d St., for himself. It will be 3 story, 50x90 ft., have pressed brick and stone front and cost $27,000. The same architect has prepared plans for 2 residences to be built at Vincennes Ave. and 48th St. They will be 2 story, each 35x70 ft., and are estimated to cost about $20,000 each.

Frederick J. Fadner will next spring build an apartment building on Stewart Ave. and 72d St., for himself. It will be 3 story, have pressed brick and stone front, and cost about $110,000.

Henry L. Newhouse, 4530 Prairie Ave., has prepared plans for an apartment building, to be built at Prairie Ave. and 59th Pl., for Anna B. Coulter. It will be 3 story, have pressed brick and stone front, and cost $35,000.

Perley Hale, 135 Clark St., is preparing plans for an apartment building to be built on the west side. It will be 3 story, 50x125 ft., have pressed brick and stone front, and cost $35,000.

Champaign, Ill.—It is reported that bids will be received until Dec. 1 by the First Methodist Society (A. P. Gulick, Trus.) for erecting a church; probable cost, $50,000.

Des Moines, Ia.—The Trus. of the Elmwood United Presbyterian Church, it is stated, have purchased a site and are having plans prepared for an edifice to cost $12,000.

*Chas. Weitz & Sons, 713 Mulberry St., it is stated, have secured the contract to erect an apartment house for Mrs. J. S. Kidd at a cost of about $47,955.

Coffeyville, Kan.—It is reported that the congregation of the Presbyterian Church has accepted the plans of Henderson & Lundberg for a new edifice which it is proposed erecting at a cost of $20,000. Rev. C. D. Alsapug, Pastor.

Louisville, Ky.—It is stated that V. H. Englehard, Pres. of the Commercial Club, intends erecting a residence in Bonnycastle, to cost $15,000.

New Orleans, La.—The congregation of the First Methodist Church, it is stated, is contemplating the erection of an edifice on St. Charles St., to cost $60,000.

Springfield, Mass.—The Holy Family R. C. Church, it is stated, is planning to erect a $75,000 edifice. Address pastor.

Brookline, Mass.—It is reported that F. P. Addicks, of New York City, has given $35,000 for additions to All Saints' Episcopal Church and for the erection of a parish house in memory of Elizabeth Addicks, his wife.

New Prague, Minn.—Bids will be received until Dec. 14 by Jos. T. Topka, Secy. Bldg. Com., for furnishing material and erecting a church for St. Wenceslaus Congregation. Herman Kretz, Archt., St. Paul.

St. Elizabeth, Mo.—It is reported that bids are wanted until Dec. 8 for erecting a church for the St. Laurence R. C. Society. I. N. Schell, Secy.

**Items marked thus give the names of parties awarded contracts.*

Brooklyn, N. Y.—Plans have been filed for a 3-story brick tenement, to be erected at Ave. H, and 12th Sts., at a cost of $20,000. T. Schmidt, 1510 Ave. C., owner, and A. W. Sheffield, 158 E. 19th St., archt.; also plans for a 4-story brick tenement, to be erected on Classon Ave. and Degraw St., at a cost of $20,000. T. H. Frazer, 727 Eastern Parkway, owner; A. McLean, 883 E. 35th St., archt.

The members of Vanderveer Park M. E. Church are contemplating the erection of a new edifice to cost $20,000.

New York, N. Y.—Plans have been filed for a brick and stone church, to be erected at 45 W. 134th St., for the Congregation Mercy Seat Baptist Church, at a cost of $30,000. Jas. J. F. Gavigan, Archt., 1123 Bway.

Portland, Ore.—The St. Francis R. C. Church, at E. Oak and 11th Sts., it is stated, is preparing to erect a $35,000 edifice. Rev. J. H. Black, pastor.

Philadelphia, Pa.—J. S. Cornell & Son, Land Title Bldg., it is stated, have secured the contract to erect a residence on 22d and Locust Sts., the cost to be about $50,000.

Pittsburg, Pa.—S. A. Marsteller, it is stated, has prepared plans for an apartment house which is to be erected by S. W. Gault and W. W. Giffen at Louisa St. and McKee Pl., at a cost of $35,000. It is reported that bids for the construction will soon be asked.

Memphis, Tenn.—Frank F. Hill, it is stated, is having plans prepared by Chighizola, Hanker & Cairns, for a residence which he intends erecting at Union St. and Garland Ave., at a cost of $35,000.

Toronto, Ont.—The Trus. of Annette St., Baptist Church, of Toronto Junction, it is stated, have decided to erect a new brick edifice at Annette St. and High Park Ave., to cost $16,000.

The Bldg. Com. of the Knox Church, it is reported, has decided to erect a Sunday School on Spadina Ave., to cost about $40,000.

New York, N. Y.

West End Ave. and 106th St., 12-story br. and stone apartment house; c, $275,000; o, Stanley Court Realty & Constr. Co.; a, Chas. E. Birge.

139th St. and Amsterdam Ave., 6-story br. and stone tenemt.; c, $48,000; o, Schlesinger & Fersichel; a, E. A. Meyers.

144th St. and Bway., 5-story br. and stone tenemt.; c, $50,000; o, Elias Gussaroff; a, Moore & Landsiedel.

Edgecombe Ave. and 150th St., 2 5-story br. and stone tenemts.; total c, $84,000; o, Murray & Hill; a, J. C. Cocker.

Edgecombe Ave. and 150th St., 2 5-story br. and stone tenemts.; total c, $84,000.

180th St. and St. Nicholas Ave., 2 5-story br. and stone tenemts.; total c, $70,000; o, Harris & Isaacs; a, Wm. Allen Balch.

152d St. and Courtland Ave. 6-story br. tenemt.; c, $45,000; o, Mr. McWhirter; a, M. J. Garvin.

662 158th St., 6-story br. tenemt.; c, $60,000; o, Jacob Hirsch; a, Geo. F. Pelham.

155th St. and Morris Ave., 6-story br. tenemt.; c, $35,000; o, Heubner & Escher; a, Horenburger & Straub.

162d St. and Melrose Ave., 2 6-story br. tenemts.; total c, $60,000; o, Werner Knaus Realty Co.; a, M. J. Garvin.

162d St. and Prospect Ave., 5-story br. tenemt.; c, $25,000; o, Mrs. Susanna Wirth; a, Kurtzen & Rentz.

Union Ave. and 163d St., 2 5-story br. tenemts.; total c, $70,000; o, The Gaines-Roberts Co.; a, Harry T. Howell.

Union Ave. and 161st St., 6 6-story br. tenemts.; total c, $210,000; o, Syndicate Constr. Co.; a, E. G. Gollner.

17 E. 73d St., alterations to 4-story br. and stone dwell.; c, $20,000; o, Ralph Pulitzer; a, Foster, Gade & Graham.

SCHOOLS.

Notes Arranged Alphabetically by States.

Arkadelphia, Ark.—The School Bd., it is stated, is considering the erection of a school at a cost of about $25,000.

Fordyce, Ark.—C. L. Thompson, of Little Rock, it is reported, has prepared plans for a $15,000 school which is to be erected here.

Little Rock, Ark.—It is reported that the Presbyterian Society (H. H. Foster, Chmn.) has decided to erect a $100,000 seminary.

San Francisco, Cal.—It is reported that plans have been submitted by City Archt. Shea for 5 schools, namely: Bay View Grammar School, to be erected at Flora and Bay View Sts., cost $119,000; Monroe Primary, at London St. and China Ave., cost $81,000; the Winfield Scott School, Lombard and Broderick Sts., cost $39,000; Park School, Sixth Ave. and B St., cost $81,000, and the Girls' High School annex, at Geary and Scott Sts., cost $165,000.

It is stated that the Secy. of the Bd. of Pub. Wks. has been authorized to receive bids until Nov. 26 for erecting the Sunnyside, Washington Grammar and Laguna Honda schools.

San Diego, Cal.—It is reported that the Bldg Com. of the Bd. of Educ. will soon ask plans for the high school which is to be erected to replace the Russ High School, and for which $135,000 bonds have been sold.

Wallingford, Conn.—Bids will be received until Dec. 4 by the Bldg. Com., Central School Dist. (Geo. T. Jones, Chmn.) for furnishing material and erecting brick and stone school. Bids may be submitted as a whole or separately on the following: Masonry, carpentry, plumbing, ventilating and heating and electric wiring. Allen & Williams, Archts., New Haven.

Washington, D. C.—It is reported that the Memorial Assoc. has agreed to undertake the raising of $500,000 for the erection of the central building in the group, which it is proposed erecting in Van Ness Park, at the George Washington Univ., to be known as the George Washington Memorial, and to be used for administrative and lecture purposes.

Monticello, Ind.—It is stated that bids will be received until Dec. 6 by W. S. Bushnell, Secy. School Bd., for erecting a school. Chandler & Parks, Archts., 400 Main St., Racine, Wis.

Topeka, Kan.—It is stated that the State Archt. is about to prepare plans for a gymnasium for the State Univer., the cost to be about $100,000.

Middleboro, Ky.—The citizens, it is stated, voted on Nov. 7 in favor of issuing $15,000 bonds to erect a school.

**Baltimore, Md.*—Milton C. Davis, 22 Builders' Exchange, it is reported, has secured the contract to erect School No. 10 on Hollins St., bids for which were received Nov. 1, at $34,380.

Boston, Mass.—The following are the bids opened on Nov. 8 by the School House Comrs. for erecting the Charlestown High School on Monument Sq., Charlestown, including ventilating and heating, electrical and plumbing work: McNeil Bros., Dorchester, $276,344; Connery & Wentworth, Boston, $265,914; P. H. Jackson & Son Co., Brockton, $262,808; Whiton & Haynes Co., Boston, $253,715; Coburn & Boughton, Boston, $252,900; Mack & Moore, Boston, $249,900; Henry McCahey, Cambridge, $239,137.

**Everett, Mass.*—D. B. Fessenden & Co., of Everett, have secured the contract for constructing the new school for about $65,000. Architects, Loring & Phipps, 53 State St., Boston.

Quincy, Mass.—The City Council on Nov. 6 appropriated $113,000 for an addition to the high school, from plans of Aaron A. Gould, 43 Milk St., Boston.

Mt. Pleasant, Mich.—Bids will be received until Dec. 7 by the Comr. Indian Affairs, Washington, D. C. (C. F. Larrabee, Acting Comr.) for furnishing material and constructing an employees' quarters, superintendent's quarters, dairy building and industrial building, all with plumbing, steam heat and electric light. For further information, apply to Robt. A. Cochran, Supt. U. S. Indian School, Mt. Pleasant.

Marquette, Mich.—Bids will be received until Dec. 29 by the State Bd. Educ. (Patrick H. Kelley, Secy.), at Lansing, for erecting a 1-story and basement addition to the Northern State Normal School, at Marquette. E. W. Arnold, Archt., 278 Garfield Ave., Battle Creek.

Miles City, Mont.—The Bd. of Trus. of the Custer County Free High School, it is stated, is considering the bonding of the county to erect a high school. It is stated that about $35,000 will be needed, according to the estimate of the archt., for the erection and equipment of the building.

Bancroft, Neb.—It is reported that plans have been completed for a $25,000 school, and it is stated that bids for the erection will probably be received in Jan.

Newark, N. J.—The Bd. of Educ., it is stated, has engaged C. B. J. Snyder, of N. Y. City, to act as consulting archt. for the new Technical High School.

Bids will be received until Nov. 22 by the Com. on repairs, heating and sanitation of the Bd. Educ. (R. D. Argue, Secy.) for furnishing material and installing heating apparatus, etc., in 7th Ave. school. Percy B. Taylor, Engr., 365 Market St.

Irvington, N. J.—It is stated that the Bd. of Educ. is considering the erection of additions to the Florence Ave., Colt and Grove Sts. schools, the total cost to be about $23,000.

Hoboken, N. J.—It is stated that bids will be received until Nov. 27 by the Bd. Educ. (Wm. A. Kerr, Secy.) for erecting a school at 2d and Monroe Sts. Eugene Ciccarelli, Archt., Second Natl. Bank Bldg.

Troy, N. Y.—Bids will be received until Nov. 24 by the Bd. of Contract & Supply (Jas. M. Riley, Clk.) for material and labor required in building the approach and the extension and opening of Bway., from Institute Alley to 8th St., through the lands required by deed from the Rensselaer Polytechnic Inst., the work to consist of the construction of foundations, conduit, furnishing granite, carving, bronze work, electrical work, heating and plumbing, in accordance with the plans and specifications prepared by Demers & Campaigne, Ilium Bldg. Estimated cost, $38,000.

New York, N. Y.—Plans have been filed for a 3-story brick and stone school to be erected at 131st St. and Convent Ave., at a cost of $50,000, for the Parish Church of the Annunciation. Lynch & Orchard, Archts., 1 W. 34th St.

Plans have been filed by the Bd. of Educ. for a 4 and 5 story building for School No. 27, in E. 42d St. It is to be of brick with terra cotta trimmings and is estimated to cost $300,000.

Buffalo, N. Y.—The following are reported to be the lowest bids received Nov. 2 on various parts of the work, in connection with the erection of a 16-room brick school in Dist. No. 29, on S. Park Ave. Bids being submitted on 2 plans, the figures given being respectively: Peter H. Frank, masonry and stone, $30,650 and $24,975; Christian Flierl, carpentry, etc., $18,385 and $12,370; Penn Metal Ceiling and Roofing Co., roofing and metal work, $2,448 and $2,350; Vaux & Co., the same on both plans for ventilating and heating at $9,220; Barnd & Geiger, plumbing work, $5,606 and $4,031.

Rochester, N. Y.—The Barrington School, No. 23, it is reported, has been destroyed by fire.

Albion, N. Y.—Lyman S. Linson, Clk. Bd. Educ., writes that E. E. Joralemon, of Niagara Falls, is architect for the proposed high school, to cost about $75,000.

Sayville, L. I., N. Y.—It is stated that the Bd. of Educ. is considering the erection of an addition to the school at a cost of $15,000.

**Castleton, S. I., N. Y.*—The following are the bids opened on Nov. 13 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing, ventilating and heating apparatus for additions to and alterations in School 16, Castleton, Boro. of Richmond: Rossman & Bracken Co., $14,000; Leonard D. Hosford, 68 Beekman St., N. Y. City, $13,725 (awarded contract), E. Rutzler Co., $14,800.

Bids will be received until Nov. 27 by C. B. J. Snyder, Supt. School Bldgs., New York City, for sanitary work and gas fitting in additions to and alterations in School 16, Castleton; also in School No. 23, Mariner's Harbor, both in Boro. Richmond.

**Port Richmond, S. I., N. Y.*—The following are the bids opened Nov. 13 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction, etc., of School 21, at Port Richmond, Boro. of Richmond: P. J. Walsh, $107,700; Thos. Cockerill & Son, $103,013; Ph. Wolff & Son, $97,700; Buckley Realty Constr. Co., $103,126; Geo. Hildebrand, 1504 Bway., N. Y. City, $96,788 (awarded contract), Chas. H. Beckwith, $101,329.

Zanesville, O.—The citizens on Nov. 7, it is reported, voted in favor of issuing $130,000 bonds for erecting a high school and for additional rooms to the Garfield and Grant Schools.

Lockland, O.—Bids will be received until Dec. 4 by the Bd. Educ. of Lockland Village School Dist. (Wilbur S. La Rue, Clk.) for $10,000 bonds for erecting a school.

**Stillwater, Okla. Ter.*—It is stated that A. O. Campbell, of Oklahoma City, has secured the contract to erect Morrill Hall at the Agriculture College, at $62,800. The plumbing, heating, etc., of the building, is to be done by the engineering department of the College.

**Shawnee, Okla. Ter.*—B. L. Coombs, it is stated, has secured the contract to erect the normal school here at $41,660.

Pittsburg, Pa.—It is reported that plans have been completed for a $50,000 building to be erected for the Wilkins School.

Spartanburg, S. C.—School bonds amounting to $30,000, it is reported, have been sold.

Seattle, Wash.—It is reported that bids will be received until Nov. 25 by M. H. Gormley, Co. Treas., for $500,000 school bonds.

Buckhannon, W. Va.—It is reported that plans are being prepared for a $25,000 school.

Montreal, Que.—The Catholic School Comrs. it is stated, have been granted a permit to erect a 4-story school at 219 Fulton St., to cost $40,000.

Ciudad Juarez, Mex.—An agreement has been reached between Escobar Hermanos, of Chihuahua, and Enrique C. Creel, Governor pro tem of Chihuahua, whereby a school of agriculture is to be established in Ciudad Juarez at a cost of $50,000.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Bloomsburg (Pa.) Paper Mill, recently destroyed by fire, will be rebuilt according to local reports.

The A. Geo. Schultz Co., Milwaukee, Wis., will build an addition to its paper box factory, according to local reports.

American Writing Paper Co. will build an addition to its Harding branch at Franklin, O., according to local reports.

Sill Stove Works, Rochester, N. Y., will erect a new plant and will install a power plant with a capacity of approximately 200 h.p.

F. E. Reed & Co., Rochester, N. Y., have purchased site in that city for a large glass plant, according to local newspaper reports.

The Lattimer-Williams Mfg. Co., Columbus, O., mfrs. of stoves and ranges, is having plans prepared for a new foundry, to measure 100 x 250 ft.

The West End Paper Stock Co., Chicago, Ill., will build an addition to its plant, to consist of a 4-story building, measuring 25 x 100 ft., according to local reports.

The Brown Shoe Co., St. Louis, Mo., has purchased site for a new shoe factory, to have a capacity of 5000 pairs of shoes per day, according to local newspaper reports.

Iroquois Iron Co., South Chicago, Ill., has purchased a tract of 30 acres of land adjoining its present plant and will erect an additional plant when plans have been completed.

The Goodyear Lumber Co., Rochester, N. Y., will shortly establish a large plant in the South, to have a capacity of 1,000,000 ft. of lumber per day, according to local newspaper reports.

Mr. J. D. Grimes, Lexington, N. C., is interested in a new knitting mill to be built at that point. The new building will measure 50 x 50 ft.; 2 stories high. The plant will be operated by electricity.

Taylor Iron & Steel Co., High Bridge, N. J., will build an extension to its steel foundry. The new building will measure 200 x 138 ft., and contract for same has been awarded to the Eastern Steel Co.

Detroit (Mich.) Sulphite Pulp & Paper Co. is reported to be preparing plans for extensive improvements, to cost $300,000. These improvements include a new water supply system and a power plant having a capacity of 3,000 h.p.

The Prairie State Paper Mill, Taylorville, Ill., has begun the erection of an addition to its present plant, which will increase the capacity to thirty tons of paper bags per day, according to local reports. Fifteen additional bag machines will be installed.

The Wonder Mfg. Co., Mt. Pleasant, Pa., is erecting a stove and foundry plant, consisting of main building, 90 x 224 ft., with cupola, power and japanning buildings. Power equipment not yet decided upon. The company is considering steam and electricity.

The West Louisville Brewing Co., Louisville, Ky., will build an addition to its present plant consisting of 4-story brick building, measuring 50 x 150 ft. The cost of building and equipment will be $50,000, and the plant will have a capacity of 100,000 bbls. per year.

Enterprise Wire and Iron Works, Baltimore, Md., has purchased site for a new plant. The new building to be erected at this time will measure 50 x 160 ft. The plant will be equipped with modern electrically operated machinery for the manufacture of wire and ornamental iron work.

Indiana (Pa.) Bent Rung Ladder Co. will build a new plant in the South as soon as a suitable location can be secured. The main building will be one story high, measuring 50 x 300 ft., with a wing 60 x 100 ft. Amount of power to be used will be 250 h.p. This company will also establish a plant on the Pacific Coast, probably at Portland, Ore.

Pacific Coast Gypsum Co., Tacoma, Wash., is erecting a new plaster mill. The building will measure 85 x 120 ft., and will be 2 or 3 stories high. The equipment will consist of nipper, grinder, calcining kettles, regrinders, mixers, conveyors and elevators. The plant will probably be operated by electric motors, though this point has not been definitely determined.

**Items marked thus give the names of parties awarded contracts.*

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Dec. 19, to furnish at the navy yard, Mare Island, a quantity of machine tools, etc., as follows: Schedule 235, Elevator. Schedule 236, Angle shear, key seater, pipe cutting machine. Applications for proposals should designate by numbers the schedules desired. H. T. B. Harris, Paymaster Gen., U. S. N:

Washington, D. C.—See "Power Plants, Gas and Electricity."

**Washington, D. C.*—Maj. Frederick V. Abbott, Corps Engrs., U. S. A., writes that the contract for furnishing and delivering chain ammunition hoists (bids opened Nov. 3 at the office of the Chief of Engrs., U. S. A., War Dept.) has been awarded to Deitrich Bros., 344-362 North St., Baltimore, Md.

Evanston, Ill.—At a recent meeting of the Drainage Board at Chicago, it was voted to change the line of the Evanston auxiliary channel 300 ft. west of the original route, at the intersection of Lincoln and Peterson Aves.

Chicago, Ill.—The citizens on Nov. 7 voted in favor of issuing $2,000,000 bonds for the completion, improvement and maintenance of various parks and boulevards; also to issue $1,000,000 bonds for the acquisition, improvement and completion of smaller parks and pleasure grounds, under control of the West Chicago Park Comrs.

**Clinton, Ill.*—The Cain Constr. Co., of Dayton, O., has secured the contract for constructing about 20,951 ft. vitr. salt glazed tile drain including excav. and refill. for $13,956. Engineer, J. G. Melluish, Bloomington.

Ft. Dodge, Ia.—It is stated that bids will be received until Dec. 5 by H. S. Holm, Co. Aud., for constructing a joint county drainage ditch, requiring about 92,000 cu. yds. excav.

Port Allen, La.—Bids will be received until Dec. 2 by the Bd. Comrs., Choctaw Basin Drainage Dist. of West Baton Rouge (H. Wilkinson, Pres.) for $40,000 bonds.

Baltimore, Md.—The budget for 1906, which has now been finally fixed by ordinance of the Mayor and Council, is reported to contain an appropriation of $1,000,000 for building new wharves and docks.

Bids will be received by Wilton Snowden, Pres. Bd. Comrs. of Finance, Mayors' office, City Hall, until Nov. 22 for the purchase of $3,000,000 of the registered stock of the city, to supply additional means for the Burnt District Commission's plan of improvements.

Portsmouth, N. H.—Bids were opened on Nov. 11 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the removal of earth and rock at the Navy Yard, Portsmouth: Each bidder submitted two lump sum bids as follows: (*a*) for removal of 8,470 cu. yds. rock, and 10,430 cu. yds. earth, (*b*) for removal of 11,460 cu. yds. rock and 13,325 cu. yds. earth: Boston & New York Contr. Co., 220 Devonshire St., Boston, Mass., *a* $14,532, *b* $18,939; American Truck Co., Wentworth St., Kittery, Me., *a* $23,198, *b* $30,915; Jas. H. Ferguson, 22 Parkman St., Dorchester, Mass., *a* $18,245, *b* $24,232; Hervey A. Hanscom, 53 State St., Boston, Mass., *a* $18,900, *b* $24,785; T. H. Gill & Co., 88 Broad St., Boston, Mass., *a* $17,900, *b* $21,230; O'Brien & Hoolihan Contr. Co., 1722 Park St., Syracuse, N. Y., *a* $19,915, *b* $26,363; John J. Fitzpatrick, 29 Hamilton St., Plattsburg, N. Y., *a* $17,663, *b* $23,499.

Troy, N. Y.—See Schools.

Brooklyn, N. Y.—Bids will be received until Nov. 27 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing fire alarm telegraph system in Schools 2, 4, 5, 7, 8, 9, 10, 12, 13, 15, 30, 32, 39, 40, 47 and 111 Boro. Brooklyn.

Brooklyn, N. Y.—Bids will be received until Nov. 28 by the Bd. Health, New York City (Thos. Darlington, M. D., Pres.) for furnishing material and installing a pipe system in the underground gallery at the Kingston Ave. Hospital, Boro. Brooklyn.

New York, N. Y.—Bids will be received by Col. W. R. Livermore, Corps Engrs., U. S. A., Army Bldg., N. Y. City, until Nov. 28 for dredging in Shrewsbury River, N. J., as advertised in The Engineering Record.

Bids will be received until Nov. 23 by the Park Bd. (Sam'l Parsons, Jr., Pres.), for furnishing material and erecting the southeast entrance gate to the New York Zoological Park, Bronx Park, City of New York.

Bids will be received by Col. W. R. Livermore, Corps Engrs., U. S. A., Army Bldg., N. Y. City, until Dec. 6, for riprap jetty at Mattituck Harbor; riprap breakwater at Sag Harbor, and for dredging in Bronx River and East Chester Creek, N. Y., as advertised in The Engineering Record.

Galveston, Tex.—The City Commission is about to receive bids for the construction of a drain in the west end at a cost of about $28,000.

Seattle, Wash.—All bids opened on Oct. 12 by Lieut. F. A. Pope, Corps Engrs., U. S. A., for dredging Grays Harbor and Chehalis River, Wash., 77,336 cu. yds., have been rejected, as being excessive. The following are the only two bids received (price given per cu. yd.): Puget Sound Bridge & Dredging Co., Seattle, 29.74 cts., and International Contract Co., Seattle, 29.99 cts.

Montreal, Que.—The Harbor Comrs. are reported to be in favor of the construction of new wharves from Victoria Pier to Laurier Pier. These will be about 250 ft. wide, total length 10,720 ft., the front of wharf to be of concrete, and the cost to be about $3,000,000.

Shippegan, N. B.—It is stated that bids will be received until Nov. 24 by the Dept. Pub. Wks. (Fred. Gelinas, Secy.), Ottawa. Ont., for constructing a wharf at Shippegan.

Havana, Cuba.—A concession for the construction and operation of a steel pier in Havana Harbor is stated to have been awarded by the Government to the Compania del Puerto, which in return for the concession is to erect a custom house. The pier will be provided with an elaborate system of electrical hoisting and traveling machinery.

Guantanamo, Cuba.—Bids will be received until Dec. 5 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the naval station, Guantanamo Bay, a quantity of sand, Portland cement, yellow pine, steel posts, expanded metal, ruberoid roofing, wrought iron or steel pipe, pipe fittings, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

PROPOSALS OPEN

For Proposals see pages 57, 60, 62 and 64.

WATER WORKS.

Bids Clos.		See Eng. Record.
Nov. 22.	Exten. of system, Vancouver Barracks, Wash.	Nov. 4
Nov. 22.	Fire mains, New York, N. Y.	Nov. 4
Nov. 22.	Boilers, etc., Phoenix, Ariz.	Nov. 4
Nov. 24.	Mains, Bloomington, Ill.	Nov. 18
Nov. 25.	Reservoir, Ft. Miley, Cal.	Nov. 4
Nov. 25.	Meters, Cleveland, O.	Nov. 18
Nov. 27.	Boiler, etc., Ft. Screven, Ga Adv. Nov. 4 to 18.	Nov. 4
Nov. 27.	Pipe, etc., Portland, Ore Adv. Nov. 4 to 11.	Nov. 4
Nov. 27.	Main, Bismarck, N. D.	Nov. 18
Nov. 27.	Boiler, Asbury Park, N. J Adv. Nov. 18.	Nov. 18
Nov. 28.	Water wks., Perry, Fla. Adv. Nov. 18.	Nov. 18
Nov. 29.	Water works, Davis, Ind. Ter.	Nov. 11
Nov. 29.	Mains, New York, N. Y.	Nov. 18
Dec. 1.	Water works, Burlington, Wash.	Oct. 14
Dec. 1.	Meters, Chicago, Ill.	Oct. 21
Dec. 1.	Water wks., Ballinger, Tex.	Oct. 28
Dec. 5.	**Dam, Glendive, Mont.** Adv. Sep. 16 to Oct. 21.	**Sep. 16**
Dec. 6.	System, Hammond, La.	Nov. 11
Dec. 6.	Intake pipe, Auburn, N. Y Adv. Nov. 18.	Nov. 18
Dec. 11.	Water wks. improv., Nampa, Idaho	Nov. 18
Dec. 13.	Pipe, etc., Vancouver, B. C.	Nov. 18
Dec. 15.	Canal work, Billings, Mont. Adv. Oct. 21 to Nov. 18.	Oct. 21
Dec. 29.	Canal, etc., Klamath Falls, Ore Adv. Nov. 4 to 18.	Nov. 4
Jan. 1.	Irrig. work, El Campo, Tex	Oct. 7
Jan. 2.	Water wks., Manila, P. I.	Sep. 30
———	Franchise, Chattanooga, Tenn. Adv. Nov. 11.	Nov. 11

SEWERAGE AND SEWAGE DISPOSAL.

Nov. 21.	Chicago, Ill.	Nov. 18
Nov. 21.	Tampa, Fla.	Nov. 18
Nov. 22.	Vancouver Barracks, Wash	Nov. 4
Nov. 22.	Brooklyn, N. Y.	Nov. 11
Nov. 22.	Gulfport, Miss. Adv. Nov. 11 to 18.	Nov. 11
Nov. 23.	Elyria, O. Adv. Nov. 4 to 18.	Nov. 4
Nov. 23.	Chicago, Ill.	Nov. 11
Nov. 24.	Shreveport, La. Adv. Nov. 11 to 18.	Nov. 11
Nov. 24.	Philadelphia, Pa.	Nov. 11
Nov. 24.	Bloomington, Ill.	Nov. 18
Nov. 25.	Des Moines, Ia.	Nov. 18
Nov. 27.	Salem, Mass.	Nov. 18
Nov. 27.	McKees Rocks, Pa.	Nov. 18
Nov. 28.	Washington, D. C.	Nov. 18
Nov. 28.	Oxnard, Cal.	Nov. 18
Nov. 30.	**Baton Rouge, La.** Adv. Oct. 28 to Nov. 18.	**Oct. 28**
Nov. —.	**Rockport, Ind.**	**Oct. 7**
Dec. 2.	Norwood, O.	Nov. 18
Dec. 4.	Washington, Ia.	Nov. 18
Dec. 6.	Chicago, Ill.	Nov. 18
Dec. 11.	**Sheldon, Ia.**	**Oct. 14**
Dec. 11.	Nampa, Idaho.	Nov. 18
Dec. 19.	Independence, Kan. Adv. Nov. 18.	Nov. 18
Dec. 20.	Bristol, Pa. Adv. Nov. 18.	Nov. 18
Dec. —.	Rockport, Ind.	Nov. 11
Jan. 12.	Manila, P. I.	Sep. 30
Feb. 1.	Woodlawn. Ala.	Oct. 28

BRIDGES.

Nov. 20.	Doylestown, Pa.	Oct. 28
Nov. 21.	St. Charles, Mo.	Nov. 11
Nov. 24.	Tacoma, Wash.	Nov. 11
Nov. 24.	Minneapolis, Minn.	Nov. 11
Jan. 1.	**Pensacola, Fla.**	**Sep. 30**

PAVING AND ROADMAKING.

Nov. 20.	Jersey City, N. J.	Nov. 18
Nov. 21.	Bayonne, N. J. Adv. Nov. 11 to 18.	Nov. 11
Nov. 22.	Southampton, Pa.	Nov. 18
Nov. 22.	Ft. Snelling, Minn.	Nov. 18
Nov. 23.	Cincinnati, O.	Nov. 4
Nov. 23.	Des Moines, Ia.	Nov. 18
Nov. 23.	Mobile, Ala.	Nov. 18
Nov. 24.	Cincinnati, O.	Nov. 4
Nov. 25.	New Orelans, **La.**	**Oct. 21**
Nov. 25.	Cleveland, O.	Nov. 18
Nov. 30.	**Baton Rouge, La.** Adv. Oct. 28 to Nov. 18	**Oct. 28**
Nov. —	Harrison, N. J.	**Oct. 21**
Dec. 1.	**Mattoon, Ill.**	**Oct. 21**
Dec. 1.	Cincinnati, O.	Nov. 11
Dec. 4.	Cincinnati, O.	Nov. 18
Dec. 4.	Union, Ind.	Nov. 18
Dec. 5.	Brownstown, Ind.	Nov. 18
Dec. 8.	Cincinnati, O.	Nov. 11
Dec. 18.	Kalamazoo, Mich.	Nov. 18

POWER. GAS AND ELECTRICITY.

Nov. 20.	New York, N. Y.	Nov. 11
Nov. 21.	**Washington, D. C.**	**Oct. 21**
Nov. 21.	**Pensalcola, Fla.**	**Nov. 4**
Nov. 21.	Washington, D. C.	Nov. 11
Nov. 22.	Baltimore, Md.	Nov. 11
Nov. 23.	Newark, N. J.	Nov. 11
Nov. 25.	Washington, D. C. Adv. Nov. 11, 18.	Nov. 11
Nov. 27.	Belle Plaine, Minn	Nov. 18
Nov. 27.	Brooklyn, N. Y.	Nov. 18
Nov. 28.	**Mojave City, Ariz**	**Nov. 4**
Nov. 28.	Washingtonn, D. C.	Nov. 18
Dec. 2.	**San Juan. Porto Rico**	**Aug. 19**
Dec. 2.	Ft. D. A. Russell, Wyo Adv. Nov. 4 to 18.	**Nov. 4**
Dec. 18.	Gas plant, Winnipeg, Man. Adv. Nov. 18.	Nov. 18
Dec. 27.	**Lockport, Ill.**	**Nov. 4**
———	Franchise, Chattanooga, Tenn. Adv. Nov. 11.	Nov. 11

BUILDINGS.

Nov. 20.	Improv. P. O., Ft. Robinson, Neb.	Nov. 11
Nov. 21.	Post bldgs., Pipestone, Minn.	Oct. 28
Nov. 21.	Jail, Linden, Ala.	Nov. 11
Nov. 21.	Almshouse, Jersey City, N. J.	Nov. 11
Nov. 22.	Htg., P. O. Bldg., Evanston, **Wyo** Adv. Oct. 21 to 28.	**Oct. 21**
Nov. 22.	**School, Phoenix, Ariz.**	**Nov. 4**
Nov. 22.	Hospital, Gowanda, N. Y. Adv. Nov. 11.	Nov. 11
Nov. 22.	School, Ticonderoga, N. Y.	Nov. 11
Nov. 22.	Boilers at hospital, Poughkeepsie, N. Y. Adv. Nov. 18.	Nov. 18
Nov. 22.	Htg. school, Newark, N. J.	Nov. 18
Nov. 23.	**Hospital, Ft. Michie, N. Y.**	**Nov. 4**
Nov. 23.	Cold storage bldg., Colon, Panama Adv. Nov. 11.	Nov. 11
Nov. 23.	Pub. bldg., New York, N. Y.	Nov. 18
Nov. 24.	School, Troy, N. Y.	Nov. 18
Nov. 25.	Pub. bldg., Washington, D. C.	Nov. 18
Nov. 26.	Schools, San Francisco, Cal.	Nov. 18
Nov. 27.	**Improv., Quarantine Sta., Tampa,** Fla.	**Oct. 28**
Nov. 27.	**Hospital, Pensacola, Fla.**	**Oct. 28**
Nov. 27.	**School, Brighton, Mich.**	**Nov. 4**
Nov. 27.	School, bldg. material, White Earth, Minn.	Nov. 11
Nov. 27.	School, Castleton, S. I., N. Y.	Nov. 18
Nov. 27.	Armory, Seattle, Wash.	Nov. 18
Nov. 27.	School, Hoboken, N. J.	Nov. 18
Nov. 28.	**Jail cells, Kansas City, Mo.**	**Oct. 28**
Nov. 28.	**Pump house, Ft. Du Pont, Del.** Oct. 28 to Nov. 18.	**Oct. 28**
Nov. 28.	**Court House, Enid, Okla. Ter.**	**Nov. 4**
Nov. 28.	**School, Mojave City, Ariz.**	**Nov. 4**
Nov. 29.	**Post bldg., West Point, N. Y.** Adv. Oct. 21 to 28, Nov. 18.	**Oct. 21**
Nov. 29.	**School, Grand Junction, Colo.**	**Nov. 4**
Dec. 1.	**Dwelling, Wilmington, N. C.**	**Sep. 16**
Dec. 1.	School, Rossmoyne, O.	Nov. 11
Dec. 1.	Church, Champaign, Ill.	Nov. 18
Dec. 1.	Bus. bldg., Muncie, Ind.	Nov. 18
Dec. 2.	Drill hall, Ft. D. A. Russell, **Wyo** Adv. Nov. 4 to 18.	**Nov. 4**
Dec. 2.	**Pub. bldg., Philadelphia, Pa.**	**Nov. 4**
Dec. 4.	Plmbg. bldgs., National Soldiers Home, Va.	Nov. 18
Dec. 4.	School, Wallingford, Conn.	Nov. 18
Dec. 6.	Plans for bus. bldg., Stockton, Cal.	Nov. 18
Dec. 6.	Pub. bldg., Baltimore, Md.	Nov. 18
Dec. 6.	School, Monticello, Ind.	Nov. 18
Dec. 7.	School, Laurel, Miss.	Nov. 11
Dec. 7.	School, Mt. Pleasant, Mich.	Nov. 18
Dec. 8.	Church, St. Elizabeth, Mo.	Nov. 18
Dec. 8.	Bus. bldgs., Montgomery, Ala.	Nov. 18
Dec. 12.	**Remodel. capitol, Bismarck, N. D.**	**Sep. 30**
Dec. 12.	Court house, Fairmount, Minn.	Nov. 18
Dec. 14.	School, Humboldt, Tenn.	Nov. 11
Dec. 14.	Church, New Prague, Minn.	Nov. 18
Dec. 20.	Pub. bldg., Annapolis, Md.	Nov. 18
Dec. 29.	School, Marquette, Mich.	Nov. 18
Dec. —	**School, Bloomington, Ind.**	**Oct. 21**
Jan. 1.	**Hotel, Davenport, Ia.**	**Sep. 30**
Jan. 4.	Post Office, Natchitoches, La.	Nov. 18
Jan. 10.	**Library plans, Toronto, Ont.**	**Sep. 23**
Jan. 10.	P. O. bldg., Reno, Nev. Adv. Nov. 18.	Nov. 18
Jan. —	**Hotel annex, Louisville, Ky.**	**Nov. 4**
Feb. 1.	Plans for armory, Hartford, Conn.	Nov. 18

MISCELLANEOUS.

Nov. 20.	Iron, steel, etc., New York, N. Y.	Nov. 11
Nov. 20.	Sand, New York, N. Y.	Nov. 11
Nov. 21.	**Supplies, Washington, D. C.**	**Oct. 21**
Nov. 21.	Supplies, Guantanamo, Cuba	Oct. 28
Nov. 21.	**Lumber, Washington, D. C.**	**Nov. 4**
Nov. 21.	Supplies, Washington, D. C.	Nov. 11
Nov. 22.	**Cement, etc., Phoenix, Ariz.**	**Nov. 4**
Nov. 22.	Dredging, New York, N. Y. Adv. Nov. 11 to 18.	Nov. 11
Nov. 23.	Tanks, Ft. Mott, N. J. Adv. Oct. 28 to Nov. 11.	**Oct. 28**
Nov. 23.	Park gate, New York, N. Y.	Nov. 18
Nov. 24.	Dredging, etc., Philadelphia, Pa. Adv. Nov. 11 to 18.	Nov. 11
Nov. 24.	Supplies, Panama	Nov. 11
Nov. 24.	School, approach, Troy, N. Y.	Nov. 18
Nov. 24.	Wharf, Shippegan, N. B.	Nov. 18
Nov. 25.	**Drains, etc., New Orleans, La.**	**Oct. 21**
Nov. 27.	**Wharf, Pensacola, Fla.**	**Oct. 28**
Nov. 27.	**Dredging, New Orleans, La.** Adv. Nov. 4 to 18.	**Nov. 4**
Nov. 27.	Garb. crematory, Grand Rapids, Mich. Adv. Nov. 11 to 18.	Nov. 11
Nov. 27.	Dredging, Tarrytown, N. Y. Adv. Nov. 11 to 18.	Nov. 11
Nov. 27.	Retaining wall, Cincinnati, O.	Nov. 11
Nov. 27.	Fire alarm system, Brooklyn, N. Y.,	Nov. 18
Nov. 28.	**Supplies, Washington, D. C.**	**Oct. 28**
Nov. 28.	Dredging, New York, N. Y. Adv. Nov. 18.	Nov. 18
Nov. 28.	Supplies, Washington, D. C.	Nov. 18
Nov. 28.	Pipe system, Brooklyn, N. Y.	Nov. 18
Dec. 1.	R. R. work, Richmond, Va.	Nov. 18
Dec. 2.	**Quay wall, Key West, Fla.**	**Oct. 21**
Dec. 2.	**Quay wall, Guantanamo, Cuba**	**Oct. 21**
Dec. 5.	Supplies, Washington, D. C.	Nov. 11
Dec. 5.	Cement, etc., Guantanamo, Cuba	Nov. 18
Dec. 5.	Ditch, Ft. Dodge, Ia.	Nov. 18
Dec. 6.	Rip rap work, etc., New York, N. Y., Adv. Nov. 18.	Nov. 18
Dec. 7.	Wharf, Ft. Moultrie, S. C. Adv. Nov. 11 to 18.	Nov. 11
Dec. 9.	Electric elevator, Norfolk, Va.	Nov. 11
Dec. 12.	Dam, Wheeling, W. Va. Adv. Nov. 11 to 18.	Nov. 11
Dec. 15.	**Telephone system, Billings, Mont.** Adv. Nov. 4 to 18.	**Nov. 4**
Dec. 15.	**R. R. franchise, Manila, P. I.**	**Nov. 4**
Dec. 19.	Supplies, San Francisco, Cal.	Nov. 18
Jan. 1.	**Statue plans, Indianapolis, Ind.**	**Jul. 22**
Jan. 1.	R. R. work, Dubuque, Ia.	Nov. 11
Jan. 9.	**Wharf, etc., Auckland, N. Z.** Adv. Nov. 4 to 18.	**Oct. 14**
Jan. 9.	**Jetty work, etc., Auckland, N. Z.** Adv. Nov. 4 to 18.	**Nov. 4**
Apr. 2,	**'06. Harbor Work, Valparaiso, Chili,** **Adv. Apr. 29 to Sep. 9.**	**Apr. 29**
———	Ditch work, Pomona, Ill. Adv. Oct. 28 to Nov. 18.	**Oct. 28**

**Items marked thus give the names of parties awarded contracts.*